Vol. 12, No. 5
March 15, 1987

Energy Research Abstracts

Abstracts 8805-10691

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT INFORMATION ON ENERGY

To provide immediate and complete coverage of literature related to major Department programs, the Office of Scientific and Technical Information provides an on-line retrieval system, data bases, and current-awareness publications. The Energy Data Base (EDB), which contains all unclassified, unlimited energy and nuclear related information processed by OSTI since 1974, and the Nuclear Science Abstracts Data Base (NSA), which covers nuclear information from 1948 through June 1976, are available for machine searching using commercial on-line retrieval systems. All information in the publications listed below, plus additional backup information, is included in the EDB. Current information being added to the EDB is available for on-line searching via the OSTI Automated Retrieval System (OARS) accessible to DOE and contractors through the Integrated Technical Information System (ITIS).

The publications described below and access to ITIS/OARS are available to Department of Energy and contractor components from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831/Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

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A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

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DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available as PB87-946800 from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 on a standing order basis through an NTIS Deposit Account. To establish an NTIS account, send the minimum $25.00 deposit to NTIS, Attn: Customer Accounts. A single issue is $12.00 for domestic (North America) and $24.00 for foreign (outside North America).

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB87-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $70.00 for domestic subscribers and $140.00 for subscribers outside the North American continent; a single issue is $8.00 and $16.00, respectively.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $80.00 for domestic (North America) and $160.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB87-901000.** Acid precipitation, including effects and possible control measures.

***Buildings Energy Technology (BET)*–PB87-900700.** Technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB87-901400.** Conversion of coal into gaseous or liquid fuels.

***Coal Combustion and Utilization (CCU)*–PB87-914400.** Coal combustion, including fluidized bed combustion, and direct utilization of coal for power generation, fuel cells, and MHD generators.

***Coal Preparation and Pollution Control (CPC)*–PB87-900800.** Coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB87-946600.** Photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB87-900600.** Biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB87-914700.** Exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*–PB87-900500.** Heavy-ion (A > 4) reactions.

***Laser Research (LAR)*–PB87-901100.** Laser research and development, excluding applications.

***Nuclear Fuel Cycle (NFC)*–PB87-913400.** Both front and back ends of the nuclear fuel cycle.

***Nuclear Reactor Safety (NRS)*–PB87-913500.** Accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB87-902900.** Management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB87-901200.** Research and development of efficient and reliable solar thermal conversion systems.

***Transportation Energy Research (TER)*–PB87-900900.** Energy-efficient advanced automotive propulsion systems and transportation energy conservation.

***Unconventional Petroleum (UCP)*–PB87-901300.** Secondary and tertiary recovery of petroleum and oil shales and tar sands.

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The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from Bernan Associates—UNIPUB, 10033-F King Highway, Lanham, MD 20706. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $355.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information on the conversion of biomass to energy. *Biomass Abstracts* is available free to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 60 IR pounds per year for participating countries and 90 IR pounds per year for nonparticipating countries. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 110 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Although the literature of science is emphasized, coverage extends to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish the mission of furnishing centralized support for Departmental elements in managing their scientific and technical information, OSTI builds and maintains computerized data bases and disseminates information via computerized retrieval systems and announcement publications such as abstract journals, bibliographies, and bulletins. Direct access to OSTI's Energy Data Base (EDB) and Nuclear Science Abstracts Data Base (NSA) is available to the U. S. scientific community through commercial on-line retrieval systems. Access to these data bases from outside the United States is available only through formal exchange agreements. The current-year EDB records, DOE Research-In-Progress, and various other specialized DOE data bases are available to DOE offices and contractors and other government agencies through the OSTI Automated Retrieval System (OARS), which is a major component of the Integrated Technical Information System (ITIS). In addition to providing access to the OSTI on-line systems, ITIS serves as a gateway to other government and commercial systems and provides information merging for customized information products. The Office of Scientific and Technical Information has developed systems to record and communicate energy-related research-in-progress information, to track research report deliverables from DOE contractors, to test and make available DOE-funded computer software programs with scientific and management applications, and to produce special publications in support of DOE program offices. To manage DOE's technical information resources effectively, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161.

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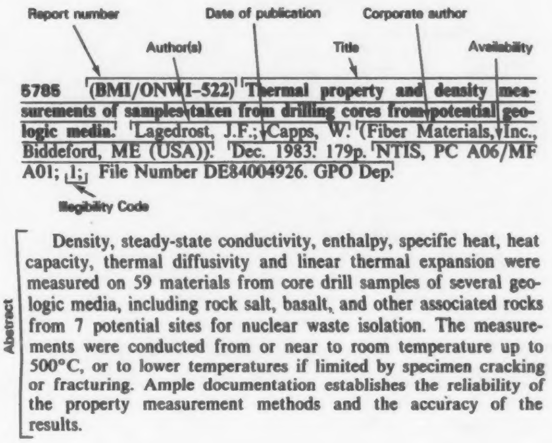
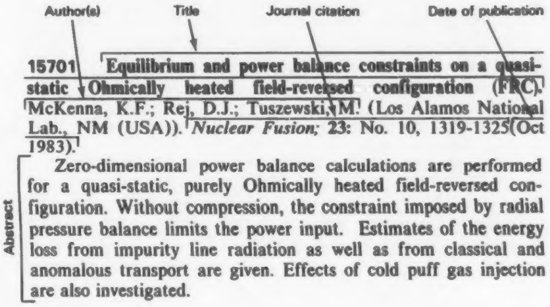
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.



15701 **Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC).** McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23:** No. 10, 1319-1325 (Oct 1983).

Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
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• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785	 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number-report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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CEA Centre d'Etudes de Saclay
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NOVA Information Services Company
Commack, NY

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 41 first-level and 276 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

8805 (DOE/PETC/QTR—86/1) **[Pittsburgh Energy Technology Center]: Quarterly technical progress report for the period ending December 31, 1985.** (USDOE Pittsburgh Energy Technology Center, PA). Oct 1986. 132p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87002514.

Microbial desulfurization is the use of "bugs" to remove sulfur from coal. Four projects illustrate the variety of ways in which microbes can be used to desulfurize coal. In the liquefaction program area, a joint effort between PETC and Catalytic, Inc., was established for process-modeling studies of two-stage coal liquefaction experiments at Wilsonville. Researchers at PETC have developed a process model for Integrated Two-Stage Liquefaction and are currently focusing on characterization of an engineering (ASPEN Public) simulator. The goal of this work is to establish realistic process performance indices for different reactor configurations and coal feedstocks based on heat and material balance calculations. In another liquefaction research effort this quarter, Hydrocarbon Research, Inc., started the first bench run under its new contract for research on low-severity, two-stage liquefaction. The run is planned for 29 days and will test nine separate operating conditions. Research in the field of magnetohydrodynamics (MHD) continued at the Avco Everett Research Laboratory (AERL). A significant achievement fiscal year was the first-time operation of the Avco MK VIII channel with the total power controlled and/or consolidated using nonresistive circuitry. An electrostatic precipitator (ESP) was delivered, installed, and tested at the DOE's MHD Coal-Fired Flow Facility at the University of Tennessee Space Institute. Shakedown tests of PETC's Continuous Life-Cycle Copper Oxide Test Facility are complete. This PETC facility will be used to conduct the first integrated process tests of the Fluidized-Bed Copper Oxide Process unit for the control of SO_2 and NO/sub x/. PETC has recently initiated a project to study the fundamental properties of coal surfaces by measuring the heat of immersion of coal and its associated mineral matter using a Setaram C-80 heat flow calorimeter.

8806 (DOE/PETC/QTR—86/2) **[Pittsburgh Energy Technology Center]: Quarterly technical progress report for the period ending March 31, 1986.** (USDOE Pittsburgh Energy Technology Center, PA). Nov 1986. 141p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87003063.

Significant progress in catalytic technology was made. Union Carbide researchers discovered a new ruthenium-containing catalyst system that converts methanol to ethanol upon reaction with syngas at relatively low pressures and temperatures. The reduced reaction pressure is a major breakthrough in methanol homologation technology. Chevron Research Co. issued Interim Report No. 12 on the refining and upgrading of oils produced from Wyodak and Illinois coals by the Lummus Crest Integrated Two-Stage Liquefaction Process. This process produces high-density fuel products that have shown potential as jet fuels. Interest in development of high-density fuel and fuel products was reinforced when DOE/Air Force, DOE HQ, and PETC representatives met to discuss a program to assess the feasibility of producing jet fuel from coal-derived materials from commercial-scale synfuels plants. PETC will implement the program for the Department of Defense through an interagency agreement. Another important area of coal-research activity involves the development of flue gas cleanup technology. Successful operation of the NOXSO Flue Gas Treatment Process at a scale equivalent to the generation of 0.75 MW of electricity has demonstrated that the simultaneous removal of 95% of the SO_2 and 87% of the NO/sub x/ in the flue gas can be obtained. Hydrocarbon Research, Inc., submitted two reports following the completion of its two-year test program designed to investigate the use of a cascade-catalyst system to reduce overall product cost. PETC's coal preparation researchers recently completed a 30-test evaluation of some of the operating parameters of a heavy-liquid cyclone process. PETC's projects involving international cooperation are discussed in some detail.

0103 Preparation

REFER ALSO TO CITATION(S) 8817, 8842, 8863

8807 (DOE/FE/60339—T32) **Coal cleaning employing quaternary salts: Final report, July 1, 1985-February 28, 1986.** Hippo, E.J.; Murdie, N. (Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes). May 1986. Contract FC22-83FE60339. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002790.

Investigation into a novel approach to coal desulfurization has continued. This approach is envisioned to include a treatment step to swell coal in quaternary salt solution, followed by physical separation, chemical reaction to desulfurize the coal, and recovery of the quaternary salt. The objective of the first step of the program was to define conditions under which complete exchange of quaternary salts with coal hydroxy groups occurs, define the extent of coal swelling and changes in coal properties as a function of amount of exchange, and determine the effect of process variation on swelling rate and coal properties. Results of this reaction have demonstrated that substantial coal swelling occurs in the presence of quaternary salts. The amount of quaternary exchange is a small portion of the total OH groups present in the coal. Swelling was found to depend on the concentration of quaternary salts, ratio of solution to coal, time of exchange (less than one hour), type and amount of solvent, pH, and coal composition, but was independent of particle size (<-60 mesh), temperature, and soak time < one hour. Recent data have shown that pyrite and inertinite can be concentrated after quaternary salt treatment. Excessive swelling with little exchange indicates that changes occur in the surface chemistry of the coal during reaction. Thus, oil agglomeration and froth flotation should be improved when coals are treated with quaternary salt. Optical microscopic analysis of the treated coals indicates that swelling and exchange are maceral dependent. In addition, swelling causes liberation of pyrite and inertinite which become isolated or exposed at edge/crack sites. Work is now concentrating on the development of mineral separation from coal and recovery of quaternary salt. 12 refs., 13 figs., 17 tabs.

8808 (DOE/FE/60339—T36) **Ultrasonic vs mechanical comminution of coal 2: Final report, July 1, 1984-February 28, 1986.** Robinson, P.D. (Southern Illinois Univ., Carbondale (USA). Dept. of Geology). Apr 1986. Contract FC22-83FE60339. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002789.

The USDOE is currently exploring the possibility of using ultrasonic energy to grind coal. The economics of the method appear very favorable; however, little is known about the nature of the ultrasonically produced product. This investigation fills the information gap by characterizing ultrasonically ground coal (using scanning electron microscope/image analysis methodology) and comparing the results with equivalent data derived from conventional grinding equipment. Size, shape, and mineral liberation data were acquired from -140, -200, and -325 mesh Upper Freeport and Illinois No. 6 coal samples ground by ballmill, hammermill, and ultrasonic methods. A comparison of the results shows that the ballmill and the ultrasonic grinders produce similar, narrow size distributions when compared to the hammermill. The shape of the size distribution curves does not vary significantly as a function of size reduction. Statistical analysis of measured and derived shape factors indicates that particulate shape does not vary with grinding method, grind size, or coal type. Visual scanning electron microscope studies confirm this finding. The percentage of mineral matter liberation was found to increase with size reduction; mineral matter liberation percentages are also generally higher for the softer Upper Freeport coal. The percentage of mineral matter freed by ultrasonic grinding is roughly comparable to ballmill and hammermill methods in the -140 and -200 mesh size ranges and is clearly superior in liberating efficiency at the -325 mesh size. Ultrasonic comminution appears to be slightly less efficient than conventional grinders in the area of pyrite liberation. 12 refs., 23 figs.

8809 (DOE/PC/63032—T11) Bench scale development of the TRW process for cleaning coal (gravimelt process): Quarterly technical progress report for the period February 1986-April 1986. (TRW Space and Technology Group, Redondo Beach, CA (USA)). 23 May 1986. Contract AC22-83PC63032. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003129.

The objective of this phase of the project is to shakedown and operate a modular bench scale plant for testing the Gravimelt Process for desulfurization and demineralization of coal and to evaluate the processing of three coals, Pittsburgh No. 8, Kentucky No. 11, and Middle Kittanning. The plant consists of four modules, each operated sequentially and independently. These are: (1) the reaction section with a 14 inch diameter by 12 foot heated section rotary kiln as the major equipment, (2) the coal filtration module which includes a dissolver and wash tanks as well as a one square foot Bird rotary drum vacuum filter and associated tankage and pumps, (3) the spent caustic liquor and spent sulfuric acid regeneration module consisting of reaction tanks, feed tanks, a Bird solid bowl centrifuge for separation of mineral products and a polishing filter as the main equipment, and (4) the caustic evaporator system for conversion of the regenerated caustic liquor to anhydrous caustic for recycle to the kiln. Each module is designed for separate operation, where the product from one module becomes the feed to the next. The reaction, filtration, and regeneration modules have been constructed and the evaporator module major equipment, instrumentation, and piping has been installed. Kiln product from each of the three coals was then washed in the filtration module at several caustic levels, beginning with 50%, as well as acid and water washes to provide filtration data for specifying a complete Gravimelt washing process train. 5 tabs.

8810 (DOE/PC/63032—T12) Bench scale development of the TRW process for cleaning coal (gravimelt process): Quarterly technical progress report for the period May 1986-July 1986. (TRW Space and Technology Group, Redondo Beach, CA (USA)). 22 Aug 1986. Contract AC22-83PC63032. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003128.

The objective of this phase of the project is to shakedown and operate a modular bench scale plant for testing the Gravimelt Process for desulfurization and demineralization of coal and to evaluate the processing of three coals, Pittsburgh No. 8, Kentucky No. 11, and Middle Kittanning. The plant consists of four modules, each operated sequentially and independently. All modules of the Gravimelt process test circuit have now been constructed. This quarter, the evaporator module was completed and checked out. Also, shakedown was performed verifying operation of all components of the system and demonstrating that the evaporator can be operated to give better than design basis, completely dry, caustic at an operating temperature of less than 275°C. In addition, laboratory scale studies were performed on regenerated caustic from each of the three program coals. These tests demonstrated that there had been no loss in desulfurization capability for the regenerated caustic. It is planned to complete the modular circuit operation by making evaporation module runs on regenerated caustic, and to perform recycle studies on regenerated caustic in the kiln utilizing fresh coal. The project requirements will be completed by preparation of a final report and other project report deliverables. 5 figs., 4 tabs.

8811 (DOE/PC/63032—T13) Bench scale development of the TRW process for cleaning coal (gravimelt process): Quarterly technical progress report for the period November 1984-January 1985. (TRW Space and Technology Group, Redondo Beach, CA (USA)). Feb 1985. Contract AC22-83PC63032. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003130.

Major progress was made in defining and testing of the cocurrent leaching of coal with molten caustic. The purpose of this effort was to explore the possibility of simplifying the bench scale and proof of concept demonstration of the Gravimelt Process. While the countercurrent leaching of coal with molten caustic demonstrated ash and sulfur reductions far in excess of those required by the project scope of work, it has become apparent that implementation of countercurrent leaching at the 20 lb/h scale of this project would be more costly than the project budget would allow. This cost is due to the necessity of providing a filtration stage between each of the four reactor stages to reduce the caustic absorbed on the coal to no more than two weights per weight of coal. This is for efficient countercurrent movement of coal and caustic and to minimize regeneration requirements. Therefore, it was decided to test the potential of initially contacting the coal with only two weights of caustic and thus eliminating any need for filtration of molten caustic from coal. Thus, the product coal-caustic material leaving the cocurrent reactor contains approximately 1 to 2% dissolved sulfide and 2 to 4.5% dissolved ash upon treatment of the three project coals initially containing 3 to 4% sulfur and 5 to 10% ash and assuming 90% removal of sulfur and 95% removal of ash. These coal-derived products are then dissolved during the first stage of water washing of the coal, into a 50% aqueous caustic filtrate. They are then removed from the caustic by an aqueous regeneration route. The use of two weights of caustic per weight of coal was tested for all three project coals, Kentucky No. 11, Pittsburgh No. 8 and Bevier seams, and New Source Performance Standards were met in each case. 1 fig., 5 tabs.

8812 (DOE/PC/70776—T9) Characterization of coal surfaces: Technical progress report, 21 August to 20 November 1986. Fuerstenau, D.W. (California Univ., Berkeley (USA). Coll. of Engineering). Dec 1986. Contract FG22-84PC70776. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003364.

This quarterly report summarizes the results and accomplishments of work during the period August 21, 1986 to November 20, 1986. With an emphasis on coal beneficiation and utilization, this investigation has been directed towards delineating the fundamental aspects of the interfacial behavior of aqueous coal suspensions. A process to characterize the lyophobic/lyophilic nature of solid particulates has been developed and extensively tested utilizing not only coal samples but also other hydrophobic and hydrophilic materials in order to demonstrate the efficacy of the method. This technique has proved to be an important and reliable tool for assessing the effect of such parameters as the degree of coal oxidation and coal composition on its behavior in surface-based beneficiation processes for coal cleaning. Research work during this past quarter involved film flotation experiments for characterizing the surface of coals of two different ranks subjected to various degrees of thermal oxidation. Table 1 lists the proximate analysis (moisture, volatile matter, ash and fixed carbon) of the as-received coals used in the preparation of the oxidized samples. The oxidation procedure involved heating a 100 x 150 mesh (150 to 160 μm) size fraction of the coal sample at 150, 200 and 244°C for periods of 19 hours. This thermal oxidation was carried out in the presence of air in a mechanical convection oven (Model 26) manufactured by the Precision Scientific Group. 2 refs., 2 figs., 1 tab.

8813 (DOE/PC/72007—T10) Ultra-fine coal characterization: 9th quarterly report, March 1, 1986-May 31, 1986. Smit, F.J.; Odekirk, J.R. (AMAX Extractive Research and Development Center, Golden, CO (USA)). 30 Sep 1986. Contract AC22-84PC72007. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003122.

Research continued to relate the beneficiation characteristics of ultra-fine coal to the mineral-matter liberation and the bulk properties of the coal. Comparisons of the flotation response of Illinois

No. 6, Pittsburgh, Upper Freeport and Sunnyside coals indicate that useful correlations can be made for development of a predictive model describing froth flotation. In other work, washability test results are given showing the mineral-matter liberation achieved when grinding Illinois No. 5 and Indiana III coals to passing 44, 20 and 10 micrometers. Microscopic examinations quantifying maceral distributions and the forms of mineral-matter in Pittsburgh, Upper Freeport and Pocahontas No. 3 coals are also reported. 5 refs.

8814 **(DOE/PC/80753—T4) Development of the CNG [CNG Research Company] shattering process for coal beneficiation to produce compliance fuels: Quarterly report No. 4, July-September 1986.** Sresty, G.C. (IIT Research Inst., Chicago, IL (USA)). 1986. Contract AC22-85PC80753. 21p. (IITRI-C—06628). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002356.

The explosive shattering process for coal cleaning is based on selective comminution of the coal macerals present in coal followed by their separation from the ash minerals and sulfur compounds. The process was originally developed at IITRI in the late 1970s under the sponsorship of Consolidated Natural Gas Research Company. The overall objective of the current DOE-sponsored program is to acquire additional data on the explosive shattering process in order to determine its technical feasibility. The program is broadly divided into three tasks aimed at system refurbishment, procedure development, and product evaluation. Tasks 1 and 2 were completed during the previous reporting periods, and work on Task 3 activities was begun during the current reporting period (July through September 1986). Two samples of custom-ground coals from Illinois-6 and Pittsburgh-8 seams were received during this quarter for shattering experiments. Coal/water slurries were prepared using the Illinois-6 coal, and shattering experiments were conducted under a broad range of temperatures and pressures. Product samples were collected and analyzed to determine particle size distribution. The average particle size obtained with the coal sample used in these experiments was observed to be considerably larger than the previously obtained data under comparable operating conditions. The differences in shattering are largely attributed to the oxidized state of the new coal sample. Both samples of the feed coals and selected samples of the product were analyzed to determine chemical and physical properties. 2 figs., 5 tabs.

0104 Processing

REFER ALSO TO CITATION(S) 8806, 8813, 8837, 8839, 9033, 9034, 9548, 9580, 9690

8815 **(BMFT-FB-T—86-069) Examination of a mixed catalyst composed of iron sulfate and potassium sulfate in view of an economic use in water vapour gasification of coals in a moving bed reactor. Final report.** Huettinger, K.J.; Minges, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Chemische Technik). Sep 1986. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750788.

The project was concerned with the potassium catalyzed water vapour gasification of coal in order to demonstrate the applicability of a low cost catalyst mixture composed of potassium and iron sulfate under the conditions of a moving bed reactor at 2 MPa. The results show, that the gasification rates of high volatile subbituminous coals at 850/sup 0/C can be increased by a factor of 10, independant if an oxidizing (CO2, Ar/H2O) or a reducing gasification atmosphere (H2/H2O) is used. The sulfur of the coals (max. content 2.8 wt.%) has no inhibiting effect. A high content of mineral matter (10 to 15 wt.%) decreases the activity of the catalyst in the H2/H2O-atmosphere strongest, in the CO2-atmosphere weakest. The same effects were found in reference experiments with potassium carbonate as catalyst raw material, i.e. these effects are characteristic for potassium as a catalyst in general. Furthermore, the results have confirmed, that the mixed catalyst exhibits a similar activity like the decisively more expensive potassium carbonate, also under conditions which are relevant for the technical gasification process. Therefore, introduction of the mixed catalyst represents the first step in improving the economy of catalyzed coal gasification. With 55 refs., 5 tabs., 27 figs.

8816 **(DOE/FE/60339—T35) Microbial removal of organic sulfur from coal (bacterial degradation of sulfur-containing heterocyclic compounds): Final report, July 1, 1985-February 28, 1986.** Klubek, B.; Clark, D. (Southern Illinois Univ., Carbondale (USA)). May 1986. Contract FC22-83FE60339. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002791.

The presence of substantial levels of sulfur in coal is a major source of air pollution, and considerable afforts are being made to devise a cost-effective way of removing the sulfur. One promising method is the microbial desulfurization of coal. Recent research has shown that it is possible to remove almost all of the inorganic sulfur from coal using the bacteria Thiobacillus or Sulfolobus. These organisms convert sulfide to sulfate but leave the organic sulfur untouched. Certain coals, including those in the Illinois Basin, contain high levels of organic sulfur; therefore, removal of organic sulfur is also necessary. If a strain of bacteria which would effectively remove organic sulfur from coal could be found or developed and used in conjunction with an organism which removes inorganic sulfur, the result could be an effective desulfurization method. Several approaches were used in developing bacteria which remove organic sulfur. One method was to mutate a laboratory species, Escherichia coli, an organism which is genetically well-understood and whose pathways for the metabolism of sulfur-containing amino-acids have been extensively investigated. Such thiophene degraders have benn isolated and are currently being analyzed for the genes involved. The second approach is the continued development of natuarlly occurring bacteria capable of degradation using enrichment culture techniques. The degradation rates of the thiophene model compounds indexed the potential for desulfurization. 10 refs., 4 figs., 8 tabs.

8817 **(DOE/FE/60339—T41) Extraction and desulfurization of chemically degraded coal with supercritical fluids: Final report, July 1, 1985-February 28, 1986.** Chen, J.W.; Muchmore, C.B.; Kent, A.C. (Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes). May 1986. Contract FC22-83FE60339. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002785.

The overall goal of this research is to gain a better understanding of the phenomena of desulfurization of coal with supercritical alcohols. The specific research objectives, employing methanol and ethanol as supercritical solvents/reactants, were: (1) to study the chemical and physical transformations of coal; (2) to study the effect of pyrite in coal on desulfurization; (3) to study the effect of chemical pretreatment of coal on desulfurization; and (4) to study the effect of differing sulfur functional groups in coal, by comparing desulfurization attained with different coals. The degrees of physical and chemical transformations that occur when coals are desulfurized with supercritical alcohols appear to be related to the extent of desulfurization attained. Greater degrees of anisotropy (coke-like formation) are associated with greater desulfurization, implying that it is necessary for the coal matrix to undergo transformation to a fluid phase if high degrees of desulfurization are to be attained. It was found that chemical pretreatment of an Illinois No. 5 seam cleaned coal with nitric acid solution to remove the pyritic sulfur greatly enhances removed of organic sulfur during supercritical desulfurization with alcohols. Sulfur concentrations of the coal have been reduced to levels of about 0.1%. Given a run-of-mine value of 2.5% total sulfur, this represents an overall sulfur removal of more than 95%. These results suggest that the sequential processing of coal through an appropiate combination of physical and chemical cleaning steps can produce a solid fuel of high heating value, satisfactory volatile content, and total sulfur content which meets environmental standards. 10 refs., 9 figs., 2 tabs.

8818 **(DOE/MC/21315—T2) Pretreatment techniques for coal gasification. Third quarterly report, April 1-June 30, 1985.** Graff, R.A. (City Coll., New York (USA)). 1985. Contract AC21-84MC21315. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004630.

Pretreatment of coal in steam is being explored with the goal of improving the economic attractiveness of coal gasification by cogeneration of light liquid fuels. The literature citations obtained by a computer search have been examined and a draft of the literature survey report is being edited. Work during this quarter was devoted to finding the cause of low liquid yields. Pulse feeding of coal slurry proved unsatisfactory. Eight shakedown runs were conducted with raw coal in which product was collected for 30 minutes. Procedures for analyzing the collected gas were established for the carbon containing species and hydrogen. Char and liquid determinations were checked by an outside laboratory. The reactor exit line and valve were checked for carbon deposits, and the amount found was not significant. The termination procedure was improved to avoid unknown char loss. Raising the tip of the injection tube to reduce premature heating of the coal slurry produced no improvement of liquid yields. A complete carbon balance showed that the low liquid yields are not the result of undetected losses. Modification of the reactor top allowed insertion of an auxiliary thermocouple to measure the temperature of the upper surface of the bed. During slurry feeding the surface temperature was very low, a result of the evaporation of water supplied with the coal. Since this is the cause of the low liquid yields, the slurry feed system will be replaced by a dry feeder. The selection of such a feeder has been initiated. The characterization of pretreated coal has begun with the elemental analyses of four samples in addition to one of the raw material. 1 fig., 2 tabs.

8819 **(DOE/PC/50003—32) Enhanced catalysis by solvent improvement. Quarterly technical progress report, 1 January-31 March 1984.** Garg, D. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Sep 1984. Contract AC22-82PC50003. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002238.

This report describes the results obtained by liquefying Illinois No. 6 coal with base liquefaction and modified solvents. Liquefaction conditions such as reaction temperature, time, initial hydrogen pressure, solvent-to-coal ratio, catalyst concentration, and type of catalyst were varied to determine their effect upon liquefaction, and to identify the reaction conditions that increase oil yields. The experimental results showed that increasing reaction temperature from 425 to 440°C in the presence of 500 ppM molybdenum catalyst based on coal significantly increased gas yield when modified solvent was used. Both oil yield and conversion, however, decreased with increasing temperature, indicating an onset of retrogressive reaction at higher temperatures. This onset may have been due to limited hydrogen transfer either from the gas to liquid phase or from the liquid phase to thermally produced molecular fragments from the coal. The effect of these limitations on coal liquefaction was investigated by changing the initial hydrogen pressure and solvent-to-coal ratio. Catalytic coal liquefaction experiments showed that the addition of 125 ppM molybdenum based on coal significantly increased both oil yield and coal conversion over those noted in noncatalytic liquefaction with modified solvent. Both oil yield and conversion increased even more when the molybdenum concentration increased from 125 to 250 ppM. However, a further increase to 500 ppM did not cause any noticeable improvement. 9 tabs.

8820 **(DOE/PC/60813—13) Hydrotreatment catalyst activity enhancement: Quarterly report No. 13 for the period August 1, 1986 to October 31, 1986.** Seapan, M.; Crynes, B.L. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). Nov 1986. Contract FG22-83PC60813. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002685.

Twelve experimental hydrotreatment runs were conducted using tetralin, aniline, and dibenzothiopene mixtures. An X-ray fluorescence analyzer was used to measure sulfur concentrations in SRC oil samples. It was found that heavy sulfur compounds of the oil may separate and accumulate at the bottom of the sample cells and cause error in sulfur concentration measurements.

8821 **(DOE/PC/70786—T7) Transition metal catalysis of hydrogen shuttling in coal liquefaction: Quarterly technical progress report, 3/1/86-5/31/86.** Eisch, J.J. (State Univ. of New York, Binghamton (USA)). 1 Jul 1986. Contract FG22-84PC70786. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003335.

The ultimate objective of this research is to uncover new catalytic processes for the liquefaction of coal and for upgrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and organooxygen constituents. Basic to both the liquefaction of coal and the purification of coal liquids is the transfer of hydrogen from such sources as dihydrogen, metal hydrides or partially reduced aromatic hydrocarbons to the extensive aromatic rings in coal itself or to aromatic sulfides, amines and ethers. Accordingly, this study is exploring how such crucial hydrogen-transfer processes might be catalyzed by soluble, low-valent transition metal complexes under moderate conditions of temperature and pressure. During the seventh quarter of this three-year grant the following aspects of this study were emphasized: (1) model studies of hydrogen shuttling were continued by examining the disproportionation reactions occurring individually with 1,4-dihydrobenzene, 1,4-dihydronaphthalene and 9,10-dihydroanthracene, as catalyzed by nickel(0) complexes; (2) attempted cleavages of benzylic carbon-carbon bonds by nickel(0) complexes were undertaken; (3) hydrogen-transfer reactions between the aforementioned dihydroaromatics and carbocyclic and heterocyclic acceptors, such anthracene, phenanthrene, pyrene and quinoline, were undertaken in the presence of nickel(0) catalysts; (4) further attempts were made to purify and isolate crystals of a homogeneous dehydrogenation agent formed from $LiAlH_4$ and Bipy.Ni.Cod, namely $LiAlH_3$.Ni.Bipy; and (5) evidence was sought that Lewis acids, such as $MeAlCl_2$, might function as cocatalysts with nickel(0) for hydrogen shuttling processes.

8822 **(DOE/PC/71257—T8) Novel experimental studies for coal liquefaction: Quarterly progress report, July 1, 1986 to September 30, 1986.** Holder, G.D.; Shah, Y.T.; Tierney, J.W. (Pittsburgh Univ., PA (USA)). 1986. Contract FG22-84PC71257. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002946.

Progress reports are presented for the following tasks: (1) thermal behavior of slurry reactors used for indirect coal liquefaction; and (2) coal liquefaction under supercritical conditions. For task 1, the experimental work during the last quarter was concentrated on determination of kinetic parameters for the reverse carbonylation reaction, an experimental study of effect of CO and CO_2 on the hydrogenolysis catalyst, and evaluation of the simulataneous two-step methanol synthesis in a single stage reactor based on the kinetic data obtained. For task 2, the experimental apparatus for supercritical fluid extraction was built and tested for supercritical conditions. The investigators have found that several samples at low flow rate reached equilibrium solibility and no solid naphthalene remained in the extractor after several runs. These results come from the fact that the solid naphthalene dissolves into CO_2 gas so rapidly under supercritical conditions. 19 refs., 11 figs., 2 tabs.

8823 **(DOE/PC/80023—T6) Development of an in-situ hydrogen measuring instrument for coal liquefaction processes: Quarterly report, July-September 1986.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1986. Contract AC22-85PC80023. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002832.

During this three-month-period two trips to Catalytic Inc. took place in order to install the hydrogen-micro-flowmeter in the plant. Because of some problems encountered in the plant, the installation could not be finished in this time period. A third trip must be carried out in order to complete the installation. For the experimental set-up installed at the University, some data were taken on the system hydrogen-ethane-tetralin. The data were in good agreement with those found in the literature. After this initial experimental study was completed, some changes in the equipment were considered in order to improve the quality of the data that can be obtained. Significant changes in the sample section are to be carried out. 5 figs., 3 tabs.

8824 (DOE/PC/80516—5) Control of catalyst deactivation with ammonia: Quarterly report for period September 1, 1986 to November 30, 1986. Satterfield, C.N.; LaVopa, V. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). Dec 1986. Contract FG22-85PC80516. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003430.

We have earlier reported that the activity of an aged Ni-Mo hydrotreating catalyst could be substantially increased by a short treatment with a 1:1 hydrogen/NH_3 mixture. This was initially observed for catalysts with (presumably) carbonaceous deposits from hydrodeoxygenation, but we find that some catalyst activity is also recovered even for catalysts coked with anthracene. We have now screened a variety of process variables to see which combination might be most effective. Reactivation was the greatest in the presence of a liquid phase and some H_2S (12 kPa) as well as ammonia and H_2. 1 ref., 2 figs., 1 tab.

8825 (DOE/PC/80531—T5) An isothermal kinetic study of the intermediate states in coal pyrolysis: Quarterly progress report for the period July 1, 1986 through September 30, 1986. Miknis, F.P. (Western Research Inst., Laramie, WY (USA)). Nov 1986. Contract FG22-85PC80531. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002708.

The objectives of this study are to examine the kinetic behavior and to characterize the intermediate states in coal pyrolysis. Isothermal kinetic experiments will be conducted on two different coals at three different temperatures using a fluidized sand bath heated reactor system. Proximate and ultimate analyses, and solid state ^{13}C NMR measurements will be used to characterize the solid products during pyrolysis, while elemental analyses molecular weights and liquid state NMR measurements will be used to characterize the coal liquids produced during pyrolysis. An on-line gas chromatograph will be used to measure the gas compositions.

8826 (DOE/PC/80910—5) A study of depolymerization and crosslinking reactions in coal liquefaction: Fifth quarterly report for the period September 1, 1986 to November 30, 1986. Solomon, P.R.; Serio, M.A.; Deshpande, G.V. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). 1986. Contract FG22-85PC80910. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003399.

The major goal of this program is to characterize the depolymerization and crosslinking reactions of low rank coals and determine how they can be optimized in liquefaction by combining high heating rates with solvent interactions. High heating rates are achieved by using a heated tube reactor where coal is heated at about 20,000 C/sec. Solvent interactions to stabilize depolymerization fragments formed at high heating rates are achieved by: (1) co-injection of a donor solvent into the heated tube reactor, (2) preswelling the coal at elevated temperatures and pyrolyzing the swelled coal in the heated grid or heated tube reactors and (3) injecting rapidly preheated coal into a hot solvent. Crosslinking and depolymerization reactions are also being studied by using polymers to simulate the chemistry occurring in coal. During the fifth quarter work was pursued in all of these areas. Slow pyrolysis of Zap lignite at 3 C/min and pyrolysis at temperatures between 50 C and 500 C for reaction time of 24 hours were carried out and the chars analyzed by quantitative FT-IR spectroscopy using the KBr pellet method and by swelling in pyridine to determine crosslink densities. For both sets of samples, a decrease in the swelling ratio due to crosslinking was found to occur with a decrease in carboxyl as well as hydroxyl groups in the char. The chars of Pittsburgh Seam bituminous formed in an entrained flow reactor at 700 C and 800 C and chars of Zap lignite formed in a heated tube reactor at an equilibrium temperature of 800 C were analyzed for crosslink densities by swelling the chars in pyridine. It seems that low temperature crosslinking (prior to tar evolution) in lignites occurs with CO_2 evolution and high temperature crosslinking (after tar evolution) in bituminous coals occurs with CH_4 evolution. 4 refs., 10 figs., 1 tab.

8827 (DOE/PC/80913—5) Biodegradation and bioconversions of coals by fungi: Technical report no. 5 for the period October 1, 1986-November 30, 1986. Ward, B. (Mississippi Univ., University (USA). Dept. of Biology). 1986. Contract FG22-85PC80913. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003391.

We have been testing for biosolubilization of coals of higher rank than lignites, and have observed bioactivity on subbituminous and bituminous coals, although the degree of solubilization is less than that for some lignites. Pretreatment of subbituminous coals with nitric acid enhances biosolubilization. Bituminous coals have not yet been tested for acid pretreatment effects. We observed that a Colorado lignite was solubilized only slightly and to lesser degree than the higher ranked coals by some tested organisms. We have assigned taxonomic identifications to several of the active isolates. One of the strains appears to be a Streptomyces, the first prokaryote that we have shown to be an active lignite-degrader. 4 tabs.

8828 (DOE/PC/90909—T1) Low severity coal liquefaction using homogeneous basic nitrogen catalysts: Technical progress report, August-October 1986. Miller, R.L.; Baldwin, R.M. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). 1986. Contract FG22-86PC90909. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002945.

During the first quarter of this project, efforts were directed towards development of low severity liquefaction experimental techniques needed to adequately measure material balance, product yield, and coal conversion data. These techniques are now in place, and initial experimental work with selected homogeneous basic nitrogen model compounds will commence in the second quarter. Results are presented for a series of four model compound experiments designed to determine whether basic nitrogen compounds such as piperidine, quinoline, and diphenylamine catalyze or promote the aqueous phase water-gas shift reaction to produce hydrogen from carbon monoxide and water at low severity coal liquefaction conditions. These data show that the extent of CO conversion is a strong function of nitrogen base strength as measured by the nitrogen compound pK/sub b/ value. 23 refs., 3 figs., 1 tab.

8829 (DOE/PC/90910—1) Enhanced coal liquefaction by low severity catalytic reactions: Technical progress report for the period August to November 1986. Davis, A.; Derbyshire, F.J. (Pennsylvania State Univ., University Park (USA). Coal Research Section). Dec 1986. Contract FG22-86PC90910. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003427.

The broad objective of the program is to examine the potential and limitations of temperature-staged catalytic hydrogenation. Specifically, experiments are planned to investigate the chemical reactions which occur during the low- and high-severity stages, the effects of coal rank and process conditions, the functions of catalysts and influence of solvent donor capability. Initial experiments were conducted on a subbituminous coal using tetralin or naphthalene as a solvent, at conditions of low and high severity and in a temperature-staged sequence. At low severity (275 C), none of the variables appeared to have an appreciable effect on conversion level or product. However, little conversion of tetralin to naphthalene took place in the presence of MoS_2 catalyst, in either a hydrogen or nitrogen atmosphere. Apparently, under these reaction conditions, an external source of hydrogen is not required. Reaction variables had greater influence under conditions of high severity (425 C). The catalyst is more efficient at promoting the transfer of hydrogen to the coal than the H-donor, has a substantial effect upon yield in the hydrogen + tetralin system, and may be able to promote the transfer of hydrogen from tetralin in the absence of a hydrogen atmosphere. The extent of the influences of reaction variables were less pronounced in temperature-staged reactions than in single-stage high severity reactions, although performance in the former was far superior. Although not apparent in the results of a single-stage low-severity run, it seems that subtle structural changes have taken place which will have a significant effect during the second stage. 3 refs., 5 tabs.

8830 **(DOE/PC/90912—T1) Low severity coal liquefaction to determine reactivity of coals: Technical progress report No. 1 for the period 6/24/86 through 8/31/86.** Chung, K.E. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). 1986. Contract FG22-86PC90912. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003123.

The objectives of this investigation are (1) to determine the reactivity of bituminous coals for liquefaction using moderate temperature hydrogenation, and (2) to examine the reaction chemistry involved in the moderate temperature liquefaction as a function of reaction time, temperature and catalyst application. The experimental work involves hydrogenation of a bituminous coal at 325°C in the absence of a donor solvent and catalyst. Then, the effect of reaction temperature and catalysts will be studied at temperatures between 300 and 350°C using two catalysts, FeS_2 and ammonium molybdate. In the first experiment, an Illinois bituminous coal was reacted at 325°C under H_2 pressure of 2900 psig for 27 h. The gaseous product contained CO_2, CO, H_2O, CH_4, C_2H_6 and C_3H_8. The CO_2 yield was 0.8% of the feed coal, and C_1-C_3 gas yield was 3.0%. These yields are approximately 50% of potential yields determined in our characterization study. The conversion to gaseous and soluble products was more than 90%. The yield ratio of oil, asphaltenes and preasphaltenes is 2:3:1. The gaseous products and high conversion reveal that the coal underwent significant chemical changes under the mild conditions. 3 refs., 2 figs., 2 tabs.

8831 **(EPRI-AP—4873) Selective oxidation of pyrites in coal: Final report.** Carlton, H.E.; Klingspor, J.; Oxley, J.H. (Battelle Columbus Labs., OH (USA)). Oct 1986. 61p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920099.

Pyritic sulfur often represents more than half the sulfur in high-rank coals. With certain bituminous coals, such as Illinois No. 6, physical coal cleaning is often ineffective due to the finely dispersed nature of the pyrite. Selective oxidation of pyritic sulfur is a problem in control; sufficient heat must be imposed to achieve oxidation of the pyritic sulfur, but not to achieve ignition of the coal with air. Processing in a fluidized bed with an air/steam fluidizing gas appears to achieve this control. Two Illinois No. 6 coals and a Montana Rosebud coal were reacted with preheated fluidizing gases (steam + air). An amount of sulfur slightly in excess of pyritic sulfur was removed from the Illinois No. 6 coals without excessive loss of heating value. With the Montana coal, above 50% of the pyritic sulfur was removed. With all coals tested to date, 40 to 60% total sulfur removal has been achieved. This method of processing appears to have potential for the desulfurization of coal fines, and may be of particular interest where sulfur-emission regulations could be met by removal of pyritic sulfur only. 9 refs., 13 figs., 6 tabs.

8832 **(EUR—9407) Development and application of the ARACHNE package to predict the efficiency and cost of processes to convert coal into synthetic fuels.** (Commission of the European Communities, Luxembourg). 1984. 274p. Commission of the European Communities, Luxembourg.

The present report describes the work performed by the National Coal Board under research contract EHC-51-018-UK. The objectives of the project have been to develop the NCB's flowsheeting computer program to permit the evaluation of direct liquefaction processes using hydrogen, and to compare the manufacture of hydrogen from coal with that of other synthetic fuels. In particular the following developments and applications of the ARACHNE flowsheeting package have been made: - a new version of the ARACHNE package (version 5) has been written and tested; - a capital costing package, IDMON, has been developed as a companion to ARACHNE; - twelve coal conversion processes based on coal gasification have been studied. Processes for the production of hydrogen, methanol, ammonia and gasoline from each of Texaco, Shell and BGC/Lurgi gasifiers have been simulated using ARACHNE and costed using IDMON; ARACHNE and IDMON constitute a flexible tool for technical and economic appraisals of chemical engineering processes. Appendices are provided: User guides to ARACHNE and IDMON; direct liquefaction simulation details; references for capital cost database; the ARACHNE 4 package; gasification study; models and details.

8833 **(NP—7770039) Transport and flow characteristics of coal dust/heavy oil suspensions.** Rejek, U.H. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 5 Nov 1981. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87770039.

The applicability of coal dust/heavy oil mixtures in coal liquefaction or as fuel is decided by the rheological characteristics of the mixture and by its flow characteristics in pipelines. The transport characteristics of brown coal and hard coal dust suspensions in heavy oil were determined in a circulation pump as a function of temperature, solids concentration, transport rate, and grain size. At solids concentrations >30% by weight, brown coal dust/oil slurries had the highest pressure losses and anthracite/heavy oil slurries the lowest. The transport energy was found to decrease with increasing grain size. (HBR).

8834 **(NP—7770040) Catalysis of water vapour gasification of coal by potassium. Studies on the introduction of catalyst raw materials of mineral origin.** Minges, R. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). 11 Jul 1985. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87770040.

This work is concerned with the catalytic effect of potassium in the water vapour gasification of carbon or coal. The particular problem is to examine the possibilities of using catalyst raw materials of mineral origin, such as KCl and K/sub 2/SO/sub 4/. These raw materials are available cheaply, but do not lead to the same low temperature activity as the much more expensive potassium nitrate. The cause is the more difficult activation in gasification conditions. The first part of the work clears up the activation of all the above-mentioned potassium compounds using thermodynamic calculations and kinetic investigations. After this, the activation reactions lead via dissociation, hydrolysis and reduction to KOH as the key substance, which is finally reduced by the carbon to the element potassium. The result is a general scheme of reactions of the water vapour gasification of carbon or coal catalyzed by potassium.

8835 **The effect of moisture on the structural stability of a coal cavity.** Mortazavi, H.R.; Emery, A.F.; Corlett, R.C.; Lockwood, W.R. (Dept. of Mechanical Engineering, Univ. of Washington, Seattle, WA 98195). *Journal of Energy Resources Technology;* **108**: No. 3, 246-253(Sep 1986).

The drying of coal and the associated thermal and moisture-induced stresses are examined with a numerical model to estimate the rate of surface regression in underground coal gasification. The model include internal convection, diffusion, conduction and flow of liquid, vapor and gas. The structural failure is modeled by three different mechanisms based upon a strength reduction due to heating, drying, or crack formation. Using properties and boundary conditions appropriate to Western United States coal, the model predicts a regression rate which is in qualitative agreement with measured results. Using the model, it is possible to examine different thermal and failure modes and to gain an understanding of some of the mechanisms which may control the surface regression of coal during gasification. These results may be applicable to the formation of rubble during gasification and to internal cavity collapse.

0106 Properties

REFER ALSO TO CITATION(S) 8812, 8814, 8835, 8858, 8860, 8863, 8864, 9502, 9573

8836 **(DOE/FE/60339—T30) Separation and fluorescence characterization of coal macerals: Final report, July 1, 1985-February 28, 1986.** Crelling, J.C. (Southern Illinois Univ., Carbondale (USA). Dept. of Geology). May 1986. Contract FC22-83FE60339. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002783.

The recent use of micronization and density gradient centrifugation (DGC) has resulted in the successful separation of coal into its constituent maceral groups; liptinite, vitrinite, and inertinite. However, little petrographic work has been done to characterize these separated substances. The overall objective of this project was to establish a density gradient centrifugation facility for the separation of coal macerals and to initiate a long-term program of characterizing the physical and chemical properties of maceral concentrates from a variety of coals of different age, rank and origin. The results indicate that the individual macerals in the same coal are being liberated from the coal matrix in the micronization process and that they are being separated at different densities in the DGC process. For example, in one Illinois Basin coal density fractions consisting of cutinite (1.08 gm/ml), resinite (1.11 gm/ml), sporinite (1.17 gm/ml), vitrinite (1.27 gm/ml), semifusinite (1.37 gm/ml), and fusinite (1.46 gm/ml) were identified. The liptinite fractions were studied in fluorescent light in which sufficient petrographic detail could be discerned to identify each maceral type. These results were confirmed by fluorescence spectral analysis which showed that the separated macerals had the same spectra as in the raw coal. In other coals both vitrinite and pseudovitrinite macerals were isolated respectively from clarain and vitrain lithotypes in the same sample. Pseudovitrinite had a higher density than the vitrinite. Fusinite and semifusinite from the same coals were also separated. Another result of these studies is that the density profile, a plot of frequency vaersus density, appears to be directly proportional to the maceral composition and, thus, can be used to characterize coal similar to the way that the reflectance histogram is now used. 16 refs., 17 figs., 7 tabs.

8837 (DOE/FE/60339—T33) Carbonyl sulfide/carbon chemistry: Interim report, July 1, 1985-February 28, 1986. Hinckley, C.C.; Shiley, R.H. (Southern Illinois Univ., Carbondale (USA). Dept. of Chemistry and Biochemistry; Illinois State Geological Survey, Champaign (USA)). May 1986. Contract FC22-83FE60339. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002792.

This interim report describes work performed during the first eight months of a continuing project, including descriptions of sample preparations and analyses. The objective of the study is to determine the effects of carbonyl sulfide, a product of the carbon monoxide/ethanol desulfurization process, on coal. A coal is first treated with carbon monoxide to reduce pyrite, and is then reacted with OCS and N_2 under various conditions. OCS is a potent resulfurization agent and appears to affect the formation of mesophase in chars derived from the coal. 8 refs., 1 fig., 8 tabs.

8838 (DOE/FE/60339—T44) Carbonyl sulfide/carbon chemistry: [Final report]. Hinckley, C.C.; Shiley, R.H. (Southern Illinois Univ., Carbondale (USA). Dept. of Chemistry and Biochemistry; Illinois State Geological Survey, Champaign (USA)). Oct 1986. Contract FC22-83FE60339. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002935.

This study examined the effects of treating isotropic char, coal tar, and coal with carbonyl sulfide, OCS. The substrates were treated with moderate pressures of OCS at 400-550°C for several hours. Gas chromatographic analyses showed that the autoclave gases contained CO, CO_2, H_2S, and unreacted OCS as the principal components after reaction. The predominant reaction was the decomposition of OCS to CO and S. Sulfur percentages for all of the treated substrates were increased by 10% or more. Polarized light reflectance microscopy showed that anisotropic carbon (mesopase) was present in coal samples treated with sulfur gases. The study demonstrates that OCS is a potent resulfurization agent for all of the substrates examined. Cabonyl sulfide and hydrogen sulfide, included in the study for comparison, facilitate the formation of mesophasic structures in the coal studied. 9 refs., 6 figs., 12 tabs.

8839 (DOE/PC/70006—11) Enthalpy and phase behavior of coal derived liquid mixtures. Technical progress report, April-June 1986. Yesavage, V.F.; Kidnay, A.J. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). 31 Jul 1986. Contract FG22-84PC70006. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86013653.

Enthalpy measurements for the m-cresol/tetralin binary system, and the quinoline/tertralin binary system have been completed and are included. A calibration check on the calorimeter was performed and is presented in Appendix C. Vapor liquid equilibria measurements for the quinoline/tetralin system have been completed for four isotherms; 250, 275, 300, and 325°C. These results and a summary of progress to date for the VLE apparatus are in the appendix at the end of this report. Also, preliminary work has begun on the quinoline/m-cresol/tetralin ternary system. Correlational work has consisted of the development of mathematical expressions for fugacity and enthalpy using various combinations of mixing rules and equations of state discussed in earlier reports. Also maximum likelihood routines has been written to determine the necessary parameters for binary data obtained in this investigation.

8840 (DOE/PC/70798—T8) Weathering effects on structure and reactivity of US coals: Fourth quarterly report. Meuzelaar, H.L.C.; Hill, G.R.; Yun, Y.; Jakab, E.; McClennen, W.H. (Utah Univ., Salt Lake City (USA). Biomaterials Profiling Center). 1986. Contract FG22-84PC70798. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003457.

Three separate experiments, i.e., oxidation under dynamic reactor flow conditions, oxidation under static conditions, pyridine extraction of fresh and oxidized coal, were performed in order to examine the role of different coal macerals on weathering. Preliminary results show that resinite and semifusinite concentrates undergo more severe oxidation changes than the vitrinite concentrate and sporinite-rich concentrate. Also aliphatic, hydrocarbon-rich coal structures thought to be derived from cutinitic or algal sources show little or no chemical changes under low temperature oxidation conditions, whereas vitrinite and sporinite show a moderate oxidation tendency.

8841 (DOE/PC/80508—3) Two dimensional and zero field NMR studies of coal structure: Progress report for the period April 1, 1986-June 30, 1986. Zilm, K.W. (Yale Univ., New Haven, CT (USA). Dept. of Chemistry). Oct 1986. Contract FG22-85PC80508. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003220.

This report covers the progress made on the title project during the last quarter. During the last three months we have concentrated on further developing zero field NMR methods so that they can be applied to coal structure problems. Designs for both shuttling and pulsed field ZFNMR systems have been finalized and construction about halfway completed. Circuits for driving the fast pulsed field and bucking field coils are completed and described herein. Test results for the piston shuttle and ZFNMR probe are also described. For the pulsed field system we have set up the power supplies neccessary to drive the pulsed magnet. The final configuration of this system is also described in this report. 5 figs.

8842 (DOE/PC/80514—05) Chemistry and reactivity of micronized coals: Technical progress report No. 5. Lloyd, W.G.; Riley, J.T.; Kuehn, K.W.; Kuehn, D.W. (Western Kentucky Univ., Bowling Green (USA)). 15 Nov 1986. Contract FG22-85PC80514. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002867.

This project examines the effect of ultrafine milling of midrank coals (to mean size below 10 microns) upon their physical and chemical properties. Additional float-sink studies of attritor-milled coals, before and after beneficiation, confirm the observation in the previous Technical Progress Report that extended milling results in compaction, collapse of micropore structure, and significant increase in coal particle density. Using precleaned coal, the float fraction at Specific Gravity 1.35 increases with initial milling - owing to the mechanical separation of mineral matter - then falls progressively with additional milling time. For extended milling runs the float fraction at S.G. 1.35 is essentially nil. This phenomenon may also explain the failure of exhaustively milled coals to show greater reactivity towards liquefaction. Our results to date indicate that optimum attritor milling times are in the range 1 to 10 minutes. Milling variables have been systematically reviewed, using the VPI mill with aqueous dispersions of -60 mesh WKY No. 9 coal. In this system the most effective size reductions, based upon sieve analyses and wattmeter measurements, are with 1/4 inch stainless steel media, agitator speed 290 to 350 rpm, charge and media filling the container about 2/3rds full at rest, coal charged at 40 to 50% V/V (45 to 55% W/W), and milling periods (depending upon application) of 1 to 4 minutes. 7 refs.

8843 (DOE/PC/90504—T1) **Configurational diffusion of coal macromolecules: Quarterly progress report, Sept. 15, 1985 to Dec. 15, 1986.** Guin, J.A.; Curtis, C.W.; Tarrer, A.R. (Auburn Univ., AL (USA). Coal Conversion Lab.). 1986. Contract FG22-86PC90504. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003442.

The objective is to investigate the phenomenon of hindered diffusion of coal macromolecules in idealized porous media. The research program consists of the following tasks: (1) construct a diffusion cell with ideal pore structure for determination of diffusivities; (2) prepare and characterize ideal porous membranes; (3) perform model compound experiments to calibrate and test diffusion apparatus and methodology; (4) prepare and characterize coal macromolecules; and (5) analyze data to evaluate the diffusional behavior of coal macromolecules. This quarter, work has focused on three areas: (1) a literature review of previous work in hindered diffusion; (2) a review of aspects of diffusion cell design and ordering of equipment for cell construction; and (3) a review of methods of making and/or obtaining suitable ideal porous membranes for use in the diffusion cell. 32 refs.

8844 (DOE/PETC/TR—87/5) **Oxidation of lignite: Annotated bibliography, 1974-1986.** Kumar, J.V.; Dahlberg, M.D. (USDOE Pittsburgh Energy Technology Center, PA). 1986. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE87003064.

Microbial solubilization of coal is being investigated because it requires rather mild operating conditions compared to thermal and chemical processes. A wide variety of fungi are able to liquefy lignites to various degrees. Recently it has become apparent that a high degree of microbial liquefaction is possible only when leonardite is used. Leonardite occurs naturally as oxidized lignite and can be produced by oxidizing lignite in the laboratory, using chemicals, gases, or heat. In an attempt to find the best suitable oxidant for the pretreatment of lignite, a literature search on the oxidation of lignite became necessary in addition to experiments. Literature citations are reported in this publication in reverse chronological order under three headings: (1) Chemical Oxidation; (2) Oxidation Using Air, O_3, or Other Gases; and (3) Thermal Oxidation. The search was limited to the years 1974 to 1986 because previous work on oxidation of coal has been reviewed by Lowry, Yohe, and Wender et al. Fifty-one articles are listed with asbstracts.

8845 (NP—7770038) **Mass spectrometer analysis of coal, its extraction with chloroform and extraction residues.** Kolb, J. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 15 Dec 1984. 180p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87770038.

The structure and thermal decomposition of hard coal of different degrees of aging were analysed by mass spectrometry. Coal samples were pyrolized in the high temperature inlet part of the mass spectrometer for this purpose. Fragments occur in the pyrolysis of coal, which can be assigned to aliphatic and aromatic hydrocarbons by pyrolysis field ion and pyrolysis electron collision mass spectra. With an increasing degree of aging of the coal, the proportion of aliphatic compounds in the pyrolysate decreases. At the same time, the proportion of aromatic compounds increases. In order to separate components of coal, the hard coal is extracted with chloroform and the extracts are examined by mass spectrometer, where aliphatic fragments are mainly obtained. Extracts heated to 550 K release mainly aromatic hydrocarbons, whose proportion is directly connected to the degree of aging of the extracted coal. H-NMR analyses confirm the findings of the product distribution found by mass spectrometry. Other explanations of the compounds formed (in the range m/z 200 to 350) are given by field ion and electron collision mass spectra via direct inlet (550 K) into the ion source of the spectrometer.

8846 (NP—7770041) **Constitution analysis of coal extracts taking into account organic sulphur compounds in particular.** Ansteeg, H.-P. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 25 Jan 1985. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87770041.

The investigations on the separation of organic sulphur compounds and hydrocarbons were done by ligand exchange chromatography. A batch process was first developed and suitable carriers and transition metals were found by model experiments. The kinetic aspects of complexing and decomplexing organic sulphur compounds in solutions were examined by these systems. The decomplexing was done with diethylamine. This can replace every basic compound from the metal complex and can form a new compound as ligand. Extract model mixtures were desulphurized with a system consisting of two successive batch reactors with the transition metal ions Cu/sup 2+/ and Pd/sup 2+/. The rates of desulphurisation were between 40 and 60%. Aromatic sulphur compounds and aryl thioether were not complexed by sulphur, which was confirmed by investigations by ligand exchange thin film chromatography. A process was developed using thin film plates coated with Cu/sup 2+/ or Pd/sup 2+/, by which the aliphatic thioether could be determined quantitatively in coal extracts. This was used as coal constitution analysis. The coal extracts were described quantitatively by the data from NMR analysis, element analysis, the mol masses from SEC and the quantitative determination of sulphur from the ligand exchange thin film chromatography process.

8847 (NP—7770042) **Characterizing a hydrating oil from hard coal with special consideration of the chemiluminescence of oxidatively generated depolymerisation products. Aromatic carbonic acid multihydrazides as model substances.** Kaufung, R. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 8 Feb 1985. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87770042.

The possibility of using the chemiluminescence methods on circulating oil oxidation products was checked in this work. The basic idea was that oxidation of coal and coal products supplies compounds, which have at least 2 carboxyl groups in the o-position of an aromatic ring, and can be changed into cyclic hydrazides capable of chemiluminescence. Substances were synthesized as model compounds, whose basic substances were proved in coal oxidation products. Following the chemiluminescence measurements, the fluorescence of the solutions and esters was examined. The spectrum position of the fluorescence maxima after the decay of the chemiluminescence reaction was identical in all cases to the chemi-luminescence maximum of the corresponding hydrazide mixture. The fluorescence maxima of the ester solutions were only in the same spectrum region for those which were treated with zinc/glacial acetic acid. The use of analytical gel permeation chromatography on circulating oil oxidation products was tested on sephadex and fractogel. The relatively early fractions contain polar compounds. (orig.

8848 **Introducing coal-water mix fuels.** Butcher, T.A.; Krishna, C.; Sapienza, R.; O'Hare, T.; Celebi, Y. (Fuels and Catalysis Div., Dept. of Applied Science, Brookhaven National Lab.). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* **92**: No. 1B, 631-639(1986). (CONF-860106—).

From ASHRAE semi-annual meeting; San Francisco, CA, USA (19 Jan 1986).

General considerations associated with the formulation and use of coal-water fuels (CWF) in heating applications are discussed in this overview. Selection of coal for CWF involves consideration of coal volatiles, heating value, ash composition and content, and equilibrium moisture. Additives that can be used to modify the fuel mix properties include dispersants, pH modifiers, stablizers, and biocides. The flow properties of the formulations produced are non-Newtonian (both time-dependent viscosity (thixotropic) and shear rate dependent viscosity). Pressure drops in piping systems are, however, still predictable and some discussion of techniques and results is included. The carrier water in CWF leads to reduced boiler efficiency, lowered flame temperatures, and increased boiler flue gas flow. The magnitude of these effects is quantified as a function of fuel water content. Approaches toward achieving flame stability are also discussed. BNLs combustion experience with boiler systems in the 1,000,000 Btu/h size class is reviewed. Studies have included moderately loaded slurries, highly loaded slurries, oil cofiring, and combustion air preheat.

8849 Ultrafine minerals in coal. Hsieh, K.C.; Wert, C.A. (Univ. of Illinois, Urbana). pp 85-98 of Process mineralogy III: applications in metallurgy, coal, concrete, smelting and exploration. Petruk, W. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1984). Contract AC02-76ER01198.

From AIME annual meeting; Atlanta, GA, USA (6-10 Mar 1983).

Mineral particles in coal have enormous variation in size. Some are large enough to be seen by eye, others can be seen with the optical microscope and still others are so small that they can be resolved only by electron microscopy. The authors paid particular attention to particles of clays and sulfides less than 1 μm in size. This paper describes typical minerals and reports on the application of the techniques of electron microscopy to coal. 16 references, 15 figures.

0108 Waste Management

REFER ALSO TO CITATION(S) 9080, 9313

8850 (BMFT-FB-T—86-079) Examination and degradation tests upon coal gasification waste water from 'Ruhr 100'-type gasifier. Final report. Koch, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1986. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750795.

Coal and oil gasification effluents are biodegradable after physico-chemical detoxification. The wastes from Ruhr 100 fit into the same scheme. Lab-scale tests show that the following sequence of 1) Solvent-Extraction, 2) Stripping, 3) Bioxidation, 4) Activated Carbon Adsorption is adequate. The results found may be used as base for plant design. With 62 refs., 26 tabs., 9 figs.

8851 (DOE/ER/60006—5) Chemical reactivity of polycyclic organic compounds adsorbed on coal fly ash and related solid surfaces: Progress report, July 1984-October 1986. Mamantov, G.; Wehry, E.L. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). Nov 1986. Contract AS05-81ER60006. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003334.

Our work has largely been concerned with the phototransformation of PAHs adsorbed on coal ashes and on various model adsorbents (silica gel, activated alumina, porous glass, graphite). Progress during the project period is summarized.

8852 (DOE/PC/81008—T6) Direct sorbent injection for combined SO_2/NO/sub x/ removal: Annual technical progress report, August 1985-July 1986. Dowdy, T.E.; Henry, J.M.; Lee, J.J.; Byrd, S.I.; Giel, T.V.; Millard, W.P. (Tennessee Univ., Tullahoma (USA). Space Inst.). 1986. Contract AC22-85PC81008. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002357.

During the year from August 1985 through July 1986, the design, construction and checkout of the Direct Sorbent Injection Facility (DSIF) was completed. Initial gas and droplet velocity mapping was conducted with the laser velocimeter equipment, and progress was made in the analytical modeling of the process. Additionally, a test plan was prepared for the drying rate and SO_2 removal tests (Series 1 and 2 testing). Included in the test plan were the calculations required for determining testing conditions and the determination of the experimental test matrix.

8853 (EPRI-CS—4811) Crystallization of calcium sulfate dihydrate and calcium sulfite hemihydrate from synthetic flue gas desulfurization solutions: Final report. Trofe, T.W.; Fishman, V.A.; Meserole, F.B. (Radian Corp., Austin, TX (USA)). Oct 1986. 71p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920107.

The precipitation of calcium sulfate dihydrate ($CaSO_4.2H_2O$) and calcium sulfite hemihydrate ($CaSO_3.1/2H_2O$) from high, up to 240,000 mg/L, total dissolved solids (TDS) solutions was studied at 50°C. The solutions were selected to cover a range of solution compositions of magnesium, calcium, sodium, chloride, and sulfate. Precipitation rates along with crystal habit and size changes were measured to determine the effects of these dissolved species as compared to dilute solution conditions. Calcium sulfate dihydrate (gypsum) precipitation rate was accelerated in the high TDS solutions, especially those containing chloride ion. Alternatively, calcium sulfite hemihydrate precipitation rate was found to be faster in high sulfate ion containing solutions. Sodium ion appears to produce gypsum crystals more columnar in habit while solutions containing high amounts of calcium produced very lamellar gypsum crystals. Solutions containing magnesium produced acicular gypsum crystals. Calcium sulfite hemihydrate solids precipitated from solutions containing high sulfate concentrations were rod shaped and globular as compared to the lamellar calcium sulfite hemihydrate crystals precipitated from high chloride and dilute solution liquors. Calcium sulfate-calcium sulfite solid solutions were characterized using infrared spectroscopy. Ion scavenging of Na, Mg, and Cl by gypsum and calcium sulfite solids precipitated from these high TDS solutions was also investigated. 10 refs., 21 figs., 13 tabs.

8854 (EPRI-CS—4845) Limestone dissolution studies: Final report. Meserole, F.B.; Eklund, B.M.; Luke, K.W.; Holcombe, L.J. (Radian Corp., Austin, TX (USA)). Nov 1986. 262p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920109.

This report is an account of research conducted on the equilibrium and kinetic relationships of selected limestones in an environment simulating that in an operating wet-scrubbing system. In particular, the reactivity and magnesium availability of selected limestones in the simulated environment were studied. The preliminary effort included a literature survey, an investigation of a method for the determination of dolomite in limestone by x-ray diffraction, and an equilibrium study to provide data from which to calculate liquid-phase activities, of calcium, magnesium, and carbonate. Information gained from these tasks was used in the subsequent research on kinetic relationships. This involved the determination of dissolution rates of calcium carbonate and magnesium carbonate in a batch solids, flow-through liquid (BSFTL) reactor over a range of process conditions. Several conclusions were drawn. High solution concentrations of magnesium were found to inhibit the dissolution of dolomitic limestones and to enhance dissolution of limestones containing solid solution magnesium. Among limestones, an increase in the magnesium content causes a decrease in the overall limestone dissolution rate but an increase in the amount of magnesium dissolved. Variables which most affected the limestone dissolution rate included pH, temperature, particle size, and aqueous sulfite concentration. The BSFTL reactor can be used to provide a relative measure of limestone reactivity. 14 refs., 24 figs., 22 tabs.

0120 Mining

8855 (NP—7770043) Investigation of materials saving options in hard coal mining. Jaegersberg, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 3 Jan 1985. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87770043.

The materials management department of a coal mine is reviewed as part of the overall organisational structure. Requirements and organisational functions are taken into account. Centralized materials management is found to be a favourable concept. An indirect, automatic control concept is recommended. Functions and limits of the logistic system are investigated. A logistic information system based on decentralized data processing is discussed. (HLN).

8856 (NP—7770044) Shortwall mining in the Federal Republic of Germany. Seidel, R. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 5 Jul 1985. 166p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87770044.

The potential effects of shortwall mining on rock mechanics are investigated. Degassing induced by rock movement is discussed, as well as the effects on the mine air condition. The effects of geological faults on longwall mining and shortwall mining are gone into. Ventilation systems and machinery for a longwall system are discussed. Costs are estimated, and cost changes are taken into account. The efficiency of the shortwall mining technique is investigated. (HLN).

0130 Transport And Handling

REFER ALSO TO CITATION(S) 8863

8857 (DOE/FE/60339—T43) **Pumping characteristics of scrubber sludge for pipeline transport and subsequent deposit in old abandoned mine shafts: Final report, July 1, 1985-February 28, 1986.** Davis, P.K. (Southern Illinois Univ., Carbondale (USA). Dept. of Civil Engineering and Mechanics). May 1986. Contract FC22-83FE60339. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002788.

This is a report on an initial eight-month project which considers the possibility of transporting scrubber sludge slurry via pipeline to abandoned mine sites for subsequent deposit into underground mine shafts. An experimental system was designed and constructed which consists of three test loops, each 87 ft in length and each having two 40-ft (approximately) straight test sections. The pipe loop diameters are 2 in., 3 in., and 4 in., respectively. Pressure drops are reported as a function of pipe diameter, solids concentration, and flow rate. Solids concentrations ranging from 25% to 55% by weight (in increments of 5%) were tested. As a part of this project, Ms. Kathy Christ and Professor C. Peter Goplerud III of the Southern Illinois University Law School analyzed the legal issues involved in disposing of scrubber sludge slurries in old abandoned mine shafts. Also, a report on related technical studies is presented. This study is being continued for twelve months; indications thus far are that the concept is indeed feasible and may have several advantages over wet disposal in surface ponds and dry disposal in landfills. 10 refs., 4 figs., 2 tabs.

8858 (DOE/PC/50270—T13) **Coal water mixture development: Quarterly technical progress report.** (TRW Space and Technology Group, Redondo Beach, CA (USA)). 13 Jan 1986. Contract AC22-82PC50270. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003131.

To evaluate equipment/component wear in coal water mixture (CWM) service, twenty-one equipment and instrumentation items were selected for dismantling and inspection, including: all four pumps, the heat exchanger, control valves, pressure relief valve, magnetic flow meters, in-line viscometers, density meters, pressure isolation spools, pressure transmitter, and material test spools. All the selected items have been removed from the test loop, and commitments have been obtained from vendor representatives for performing final inspections and reporting results. Based on the results reported to date on the inspection of the progressive cavity pump, the twin screw pump, the diaphragm pump, the heat exchanger, and material test spools, there was little or no apparent wear for these equipment items in CWM service. Additional reports on test and inspection results will be received in the forthcoming quarter. Evaluations of the pump performance data and the spiral heat exchanger data have both been completed. For either the twin screw pump or the progressive cavity pump, no degradation in pump performance was observed. In addition, the performance of the nuclear density meter was assessed by comparing its meter readings to laboratory measurements of the densities of CWM samples obtained concurrently from the test loop. The assessment results showed that the two readings were usually within 98 and 101% of each other. The Spi-Wear surface layer activation technique was utilized to measure the material loss of pipe components in CWM service. Measurements were made of four irradiated pipe components. Analysis of the data collected indicated the following annual corrosion/erosion rates for these pipe components (in thousandths of an inch per year, or mpy): 3-inch elbow - 7.1, 3-inch tee - 11.0, 1-inch elbow - 8.5, and straight section - 3.2. 1 fig., 3 tabs.

8859 (DOE/PC/50270—T14) **Coal water mixture development: Quarterly technical progress report.** (TRW Space and Technology Group, Redondo Beach, CA (USA)). 11 Jul 1986. Contract AC22-82PC50270. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003127.

All work on equipment/component evaluation, data assessment, and full scale coal water mixtures (CWM) boiler applications assessment were completed. The preparation of the final technical report which documents all the findings is near completion. The plans for the next quarter are to publish the final technical report in early July, and to present a paper on the CWM project at the Coal Utilization and Environmental Contractors' Review Meeting in Pittsburgh, PA, on July 23, 1986.

8860 (DOE/PC/50270—T15) **Coal water mixture development: Quarterly technical progress report.** (TRW Space and Technology Group, Redondo Beach, CA (USA)). 11 Apr 1986. Contract AC22-82PC50270. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003126.

Several test and inspection reports on equipment and instrumentation used in the coal water mixture (CWM) test loop were received. The reports on the pumps indicated that: (1) there was only slight loss in performance for the progressive cavity pump, and that measurements of the rotor and the drive shaft quill showed no wear; (2) the tungsten carbide coating in the housing chamber and on the rotors of the lobe pump was worn off, and there was also extensive wear in the packing area of the shaft and in the teeth of the gears. Inspection reports on a magnetic flowmeter, an isoring used for pressure measurement, and an angle control valve all suggested that these instruments were in very good condition with no loss in performance. Assessment of the hydraulic data collected during long term equipment evaluation tests has been completed. These data were used for computerized plotting of shear stress versus generalized shear rate and apparent viscosity versus generalized shear rate. The apparent viscosity data obtained from these computations are currently being used to assess the accuracy of the in-line viscometer data. Stone and Webster has completed a preliminary report covering recommended equipment for CWM plant operation, and addressing the need for upgrading of equipment and piping for CWM service in an existing oil-fired boiler facility. The report has been reviewed by TRW. A final report incorporating response to TRW's comments will be completed by June 1. The plans for the next quarter are to complete the inspection of equipment components, to complete the assessment of in-line instrumentation data, to prepare a paper for presentation at the Eighth International Symposium on Coal Slurry Fuels Preparation and Utilization, and to prepare the draft final report. 2 figs.

8861 (EUR—9141) **Peat harvesting machinery for operation on smaller bogs.** Kinsella, E. (Commission of the European Communities, Luxembourg). 1984. 10p. Commission of the European Communities, Luxembourg.

A contract (No. EEB-5-190-EIR(h)) between the Commission of the European Communities and the NBST was entered into in December 1981 for the development of a peat harvester which would be suitable for smaller peat bogs. The original design was based on an auger, which, it was hoped, would extract the peat, at the same time subjecting it to a degree of maceration. The peat would then be extruded on to a spreader arm, which when full, would deposit it on the bog surface for air drying. The machine built to this design worked so well in initial tests that a number of models were sold to interested farmers. Operation on bogs of different characteristics (surface vegetation, degree of decomposition, submerged obstacles) showed, however, that the machine, as designed, was not suitable for general application. A digger boom, delivering into a macerator, was substituted for the auger, and the machine with these attachments has worked well.

0140 Combustion

REFER ALSO TO CITATION(S) 8833, 8848, 8859, 9688, 9689, 9691, 9907

8862 (DOE/FE/60339—T31) **Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization: Final report, July 1, 1985-February 28, 1986.** Hesketh, H.E.; Rajan, S. (Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes). May 1986. Contract FC22-83FE60339. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87002786.

This study program, funded by the US Department of Energy through the Southern Illinois University Coal Research Center's Coal Technology Laboratory, was conducted during the period from July 1984 through February 1986. Two lines of testing were carried out simultaneously. One consisted of using a laboratory-scale atmospheric fluidized bed combustor (AFBC) to acquire thermodynamic data and operating characteristics for Illinois coal combustion. The other included acquisition, installation, shakedown, and operation of a large one million Btu/h pilot-scale AFBC (plus boiler and associated instrumentation). Both programs were to study Illinois reference and gob (waste) type coals.

8863 (DOE/FE/60339—T34) High-quality, multipurpose fuel derived from coal: Final report, July 1, 1985-February 28, 1986. Crelling, J.C.; Evers, J.L.; Rajan, S. (Southern Illinois Univ., Carbondale (USA)). May 1986. Contract FC22-83FE60339. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002787.

A coal-dust-air burner for combustion testing of cleaned coal and middlings has been developed, along with associated coal metering and feeding instrumentation. Details of the burner and feeder calibraton data are reported. The development of a system to study the transport and storage of micronized coal fuel is also described. The consideration of alternative systems is presented. A pneumatic transport system with a rotary air lock valve and a cyclone/filter separator has been selected for the testing of components. The device has been designed, fabricated, and installed at the Coal Technology Laboratory. Consideration of the explosive nature of dry micronized coal fuel has suggested the need for a more thorough determination of the combustion characteristics of the material, including the lower explosive concentration, the minimum explosive energy, the minimum ignition temperature, the maximum explosive pressure rise, the oxidation rate during pneumatic transport and storage, the static electrical charge produced under abrasive action for a range of humidity conditions, and the effect of humidity on the handling and storage properties of the fuel. A procedure for characterizing micronized coal has been developed using density gradient separation and fluorescence characterization. 17 refs., 14 figs., 1 tab.

8864 (DOE/FE/60339—T39) Fine particle coal as a source of energy in small-user applications: Final report, July 1, 1985-February 28, 1986. Rajan, S.; Davis, P.K.; Mitchell, T.M. (Southern Illinois Univ., Carbondale (USA)). May 1986. Contract FC22-83FE60339. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002793.

Progress made during the period 1 July 1985 to 28 February 1986 on the utilization of fine coal as a source of energy in the case of a small user (requiring about 150,000 Btu/hr of heat) is reported. Details of three aspects of the work are described: (1) design features of a 150,000 Btu/hr pulse combustor capable of operating on either fine coal or a coal-water slurry, and the progress made towards its fabrication and evaluation; (2) test results of the influence of ethyl alcohol addition to CWM to prevent freezing at low temperatures; and (3) economic analysis and results predicted therefrom on the market penetration viability of CWM for small-scale applications in the commercial and residential sectors. 85 refs., 8 figs., 4 tabs.

8865 (DOE/PC/80528—T5) Group combustion of coal particles: Annual report, September 15, 1985-September 14, 1986. Annamalai, K. (Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering). Oct 1986. Contract FG22-85PC80528. 222p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE87002873.

While most of the fundamental combustion experiments have been performed with a stream of coal/char particles, the theory used to interpret the experimental data were essentially based on the individual particle combustion model (IPC). As opposed to IPC model, a group theory is now emerging for the combustion modeling of a cloud of particles. In simple terms, the group behavior implies the formation of a single flame around a large number of drops/particles rather than flame around each individual drops/particles. In broader terms, such a behavior could also be interpreted as the change in burning characteristics due to collective behavior of a cloud of particles. The task on the formulation of nonsteady group combustion model for a cloud of coal particles has been completed. Preliminary runs has been made for the pyrolysis, ignition and combustion of a cloud of particles. The steady state results for spherical cloud of char particles lead to three possible regimes of combustion: Individual Particle Combustion (IPC), Sheath Combustion (SC), and Group Combustion (GC). Results for the transient cloud combustion of char particles are presented here and compared with steady state results. The transient results suggest that cloud ignition behavior is entirely different from individual particle ignition behavior. Even though the particles in a dilute cloud seem to ignite, the dilute cloud contributes little heat to the gas phase and cloud as a whole does not appear to ignite. Preliminary results are also presented for the group ignition of a cloud of coal particles. The results suggest that the ignition for dense cloud is initiated in the gas phase due to high volatiles concentration in a dense cloud. 54 refs., 59 figs., 11 tabs.

8866 (EUR—9818) Study of self-regulating circulation with a view to improving heat transfer between a fluidized bed and tubes, and avoiding coupling with combustion. Chrysostome, G.; Lemasle, J.M.; Large, J.F.; Guigon, P.; Ndenge, C. (Commission of the European Communities, Luxembourg). 1985. 72p. (In French). Commission of the European Communities, Luxembourg.

The research concerns the study of self-regulating circulation induced by the presence of a compact heat exchanger consisting of horizontal tubes in a fluidized bed. This phenomenon is demonstrated and the motor force of the circulation is quantified. Good heat exchange coefficients are obtained. The method offers an interesting alternative in classic industrial situations where combustion and heat recovery take place in the same part of the bed. In fact, in the case of self-regulating circulation, the presence of a compact exchanger enables us to envisage the "division" of the reactor into a distinct zone of combustion and one of heat exchange.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 9261

8867 U.S. coal exports: A reliable supply for future world growth in coal. Cardullo, M. (Energy Supply Transportation and Coal Exports, U.S. Dept. of Energy, Washington, DC). pp 31-50 of Global energy assessment and outlook. Kursunoglu, B.N.; Perlmutter, A.; Scott, L. New York, NY; Harwood Academic Pub. (1984).

The U.S. is and will maintain marginal supplier of export coal. As the export trade develops, the realization will become obvious that, even though the U.S. is a high cost supplier, it is, in the long run, one of the few if not the only timely and reliable supplier due to both extensive resources and its sound economic and political stability.

02 PETROLEUM

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 9698

8868 The influence of sample size and permeability distribution upon heterogeneity measures. Jensen, J.L.; Lake, L.W. Richardson, TX; Society of Petroleum Engineers (1986). 12p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

This study evaluates the influence of sample size upon the Dykstra-Parsons and Lorenz measures of heterogeneity. Since either coefficient is determined for a reservoir from a finite number of data, only an estimate is made of the true coefficient. The authors show that, on average, the estimate is less than the true value. They give the relationship between estimate error and sample size, and show how significant errors may arise when too few data are used. The influence of the permeability distribution upon heterogeneity measures is also studied. The author shows that a variety of distributions, exhibiting different reservoir performance, can have the same Dykstra-Parsons coefficient. The authors propose a heterogeneity measure which includes an indication of the permeability distribution. The new measure requires fewer data than Dykstra-Parsons estimator. The relationships between the new measure and the Dykstra-Parsons and Lorenz coefficients are given.

8869 A viscoelastic constitutive model for determining in-situ stress magnitudes from anelastic strain recovery of core. Warpinski, N.R.; Teufel, L.W. Richardson, TX; Society of Petroleum Engineers (1986). 12p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836. Contract AC04-76DP00789.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

A new, 3-D viscoelastic model is developed to describe the anelastic-strain-recovery (ASR) process. Measured ASR data are curve-fit to the model using a least-squares algorithm and viscoelastic material properties are calculated. The stress state at depth can then be determined given some additional information. Examples and comparisons with measured stresses are given.

0203 Drilling And Production

8870 (DOE/ER/03077—275) Polymer floods: A case study of nonlinear wave analysis and of instability control in tertiary oil recovery. Daripa, P.; Glimm, J.; Lindquist, B.; McBryan, O. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.). Nov 1986. Contract AC02-76ER03077. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003258.

Polymer flooding in oil reservoir simulation is considered in two space dimensions. The wave structures associated with such a process give rise to interesting phenomena in the nonlinear regime which have direct bearing on the efficiency of oil recovery. These waves influence and can prevent surface instabilities of the fingering mode. In this paper we resolve these waves by a front tracking method. We consider the fingering problem and the issue of oil recovery for the polymer flood. The details of these two phenomena depend on the separation between the waves and upon the viscosity contrast between the oil, water and polymer. We identify a nonlinear transfer of instability between adjacent waves and a nonlinear enhancement of recovery due to successive waves. The conclusions produced by this work are also pertinent to tracer flooding. One interesting conclusion applies to polymer injection followed by pure water injection. In this case the instability is transferred to the polymer-water interface, and the pure water region can break through the polymer to achieve direct contact with the oil. The polymer is left in narrow ribbons parallel to the main flow field and is by-passed by pure water. The effect of narrow regions of bypassed polymer can be simulated by the front tracking method and is not equivalent to numerical or physical diffusion, which would distribute the polymer more uniformly and retard the breakthrough of water through the polymer layer. 45 refs., 15 figs.

8871 (EGG-M—24786) Use of inhibitors for scale control in brine-producing gas and oil wells. Tomson, M.B.; Prestwich, S. (Rice Univ., Houston, TX (USA); Idaho National Engineering Lab., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 16p. (SPE—15457; CONF-861080—6). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836. File Number TI87000484.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

Field and laboratory work have shown that calcium-carbonate scale formation in waters produced with natural gas and oil can be prevented by injection of phosphonate inhibitor into the formation, even if the formation is sandstone without calcite binging material. Inhibitor squeeze jobs have been carried out on DOE's geopressured-geothermal Gladys McCall brine-gas well and GRI's co-production wells in the Hitchcock field. Following the inhibitor squeeze on Gladys McCall, the well produced over five million barrels of water at a rate of approximately 30,000 BPD without calcium-carbonate scaling. Before the inhibitor squeeze, the well could not be produced above 15,000 BPD without significant scale formation. In the GRI brine-gas co-production field tests, inhibitor squeezes have been used to successfully prevant scaling. Laboratory work has been conducted to determine what types of oil field waters are subject to scaling. This research has led to the development of a saturation index and accompanying nomographs which allow prediction of when scale will develop into a problem in brine production.

8872 Well sand packing prevention method. Chakrabarty, T.; Thomas, R. (to Exxon Production Research Co., Houston, TX). US Patent 4,623,022. 18 Nov 1986. Filed date 6 Dec 1984. v.p.

A method is described of preventing sand packing in a producing well completed in a zone adjacent a hydrocarbon-bearing subterranean formation, comprising the steps of: producing fluid from the hydrocarbon-bearing formation, the fluid comprising an aqueous phase and a hydrocarbon phase; and, simultaneously with the fluid production, injecting a sand control agent into the well adjacent the production zone at a rate to obtain a wellhead concentration of the sand control agent in the aqueous phase of the fluid of from about 10 to about 1000 ppm active. The sand control agent is a quaternized acylated condensed alkanolamine.

8873 On slug test analysis in double-porosity reservoirs. Sageev, A.; Ramey, H.J. Jr. Richardson, TX; Society of Petroleum Engineers (1986). 12p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

The pressure response of a double-porosity reservoir to a slug test in a fully penetrating well with wellbore storage and skin is presented. Pseudo steady state matrix flow and transient matrix flow with and without matrix skin are considered. Three kinds of type curves are discussed: early time log-log, intermediate time semi-log, and late time log-log. Pressure distribution around the active well and the prospects of interference slug testing are considered. The early time response of the slug test depends on the presence of wellbore skin, hence, two kinds of early time type curves are presented. When the active well has wellbore skin, the early time correlating parameter is the product of the skin and the dimensionless storage, resulting in a new log-log type curve. When wellbore skin is not present, the early time response is proportional to the square root of time, with dimensionless storage as the correlating parameter. The intermediate time semilog type curves are applicable when wellbore skin is not present, or C/sub D/e/sup 2S/ >10/sup 4/. The double-porosity effects are significant in the late time log-log format, but the flat portion of the pressure response occurs at dimensionless pressures less than 0.01. The radius of investigation of the slug test in a double-porosity system is also examined with and without wellbore skin at the active well. Interference responses and pressure profiles are presented. Although the presence of wellbore skin reduces the magnitude of the dimensionless pressure responses at observation wells, the detectable radius of investigation does not significantly depend on wellbore skin. Interference slug testing in a double porosity system requires high precision pressure recording tools in the observation wells, since the double-porosity effects occur at small dimensionless pressures.

8874 The effect of oil on foam stability: Mechanisms and implications for oil displacement by foam in porous media. Nikolov, A.D.; Wasan, D.T.; Huang, D.W.; Edwards, D.A. Richardson, TX; Society of Petroleum Engineers (1986). 16p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

Foam stability in the presence of Salem crude oil and pure hydrocarbons is investigated as a function of chain length of α-olefin sulfonates and electrolyte concentration. Interactions between aqueous foam films and emulsified oil droplets are observed using transmitted light, incident light inteferometric and differential interferometric microscopic techniques. Foam destabilization factors are identified including the pseudoemulsion film tension and the surface and interfacial tension gradients. Results from foam-enhanced oil recovery experiments in Berea Sandstone cores are presented using the combined gamma ray/microwave absorption technique to measure dynamic fluid saturation profiles.

8875 **Mechanisms of foam generation in glass bead packs.** Radke, C.J.; Ransohoff, T.C. Richardson, TX; Society of Petroleum Engineers (1986). 16p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

The fundamental, pore-level mechanisms of foam generation are investigated in monodisperse bead packs. First, direct visual observations identify the following generation mechanisms: lamella leave behind, gas-bubble snap off, and lamella division. Then, to ascertain the relative importance of these mechanisms, quantitative experiments are pursued on the role of bead-pack permeability (bead sizes from 0.25 mm to 1 mm), gas-phase velocity (0.001 cm/s to 0.8 cm/s), gas-phase fractional flow (0.60 to 1.0), permeability variations, and surfactant type (SDBS, SDS, Chevron Chaser SD1000, and Suntech IV 1035). The authors discover a critical velocity, above which a "strong" foam is generated and below which only "weak" foam is formed. The snap-off mechanism is the primary mechanism responsible for the formation of the strong foam. A simple model, based on the concept of a "germination site", is developed to predict the onset of snap off at higher gas velocities. New experimental data obtained in the homogeneous glass bead packs for the critical capillary number necessary to form a strong foam are in excellent agreement with the proposed germination-site model.

8876 **Application of superposition and pseudo-steady state concepts to thermal recovery pressure tests.** Onyekonwu, M.O.; Ramey, H.J. Jr.; Brigham, W.E. Richardson, TX; Society of Petroleum Engineers (1986). 12p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

The liquid flow equations have generally been adapted for use in gas flow applications even though the gas flow equations are non-linear. This follows from earlier studies in which it was concluded that although superposition is correct only for linear partial differential equations, nevertheless there is a close check between linearized real gas solutions and the liquid flow solutions. However, these earlier studies were carried out at uniform reservoir temperature. This paper discusses the application of superposition and pseudo-steady state concepts to gas reservoirs with non-uniform temperature such as thermal recovery systems. The paper is in two parts. The first part discusses verification of the finite-difference thermal simulator used for this study while the second part discusses application of the superposition and pseudo-steady state concept to thermal oil recovery falloff tests. Results from this study show that effective pressure, compressibility and temperature are required for interpretation of thermal oil recovery falloff test. The effective pressure is the same as the average pressure while the effective temperature is usually lower than the average temperature based on an energy balance. It may also be inferred from this study that non-linearity in the equations due to non-uniform temperature effects may be mild. This is because linear equations were successfully used to analyze cases with non-uniform reservoir temperature.

8877 **Mechanisms of oil displacement by microorganisms.** Kianipey, S.A.; Donaldson, E.C. Richardson, TX; Society of Petroleum Engineers (1986). 13p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

Mechanisms of oil displacement at the oil-brine-sand interfaces by bacteria were investigated by microscopic observations and capillary pressure changes using unconsolidated, thin, reservoir flow cells. Three genera of bacteria, Bacillus, Pseudomonas, and Clostridium, were injected into water-wet and oil-wet cells of unconsolidated sand, saturated with brine and crude oil. The flow cells were placed under a microscope for visual and photographic observations. The flow cells were connected to a manometer to examine the complete capillary pressure hysteresis loop before and after introduction of bacteria. The thin reservoir flow cells were first saturated with brine, and then displaced to irreducible water saturation with crude oil. Oil and brine displacements were then made to determine the complete capillary pressure relationship. Next, the bacteria and nutrients were introduced and incubated in the flow cell for 24-48 hours. Microscopic observations were recorded photographically. After incubation, oil and brine displacements were again made to determine the capillary pressure hysteresis loop.

8878 **The use of single-cutter data in the analysis of PDC bit designs.** Glowka, D.A. Richardson, TX; Society of Petroleum Engineers (1986). 16p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836. Contract AC04-76DP00789.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

A method is developed for predicting cutter forces, temperatures, and wear on PDC bits as well as integrated bit performance parameters such as weight-on-bit (WOB), drilling torque, and bit imbalance. A computer code called PDCWEAR has been developed to make this method available as a tool for general bit design. The method uses single-cutter data to provide a measure of rock drillability and employs theoretical considerations to account for interaction among closely spaced cutters on the bit. Experimental data are presented to establish the effects of cutter size and wearflat area on the forces that develop during rock cutting. Waterjet assistance is shown to significantly reduce cutting forces, thereby extending bit life and reducing WOB and torque requirements in hard rock. The effects of bit profile, cutter placement density, bit rotary speed, and wear mode on bit life and drilling performance are investigated.

8879 **Accurate Vaporizing Gas-Drive Minimum Miscibility Pressure prediction.** Benmekki, E.H.; Mansoori, G.A. Richardson, TX; Society of Petroleum Engineers (1986). 12p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

Prediction of The Minimum Miscibility Pressure (MMP) of the Vaporizing Gas Drive (VGD) process is modeled using an equation of state with different mixing rules joined with a newly formulated expression for the unlike-three-body interactions between the injection gas and the reservoir fluid. The comparison of the numerical results with the available experimental data indicates that an equation of state alone overestimates the MMP. However, when the equation of state is joined with the unlike-three-body interaction term, the MMP will be predicted accurately. The proposed technique is used to develop a simple and reliable correlation for the accurate vaporizing gas drive MMR prediction.

8880 **Laboratory testing of high-pressure, high-speed PDC bits.** Maurer, W.C.; McDonald, W.J.; Cohen, J.H.; Neudecker, J.W. Jr.; Carroll, D.W. Richardson, TX; Society of Petroleum Engineers (1986). 8p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

A high-speed drilling system has been developed which drills medium strength rocks at rates up to 1000ft/hr (328 m/hr). This system uses special motors to operate high-pressure PDC bits at pressures up to 10,000 psi(69 MPa) and at speeds of 800 to 1000 RPM. High drilling rates were achieved due to the high rotary speeds and the use of PDC cutters to remove the rock ledges left on the hole bottom by the high-pressure jets.

8881 **Temperature dependence of L/sub 1/-L/sub 2/-V behavior in CO/sub 2/-hydrocarbon systems.** Larsen, L.; Silva, M.K.; Taylor, M.A.; Orr, F.M. Jr. Richardson, TX; Society of Petroleum Engineers (1986). 8p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

The temperature dependence of liquid-liquid (L/sub 1/-L/sub 2/) and liquid-liquid-vapor (L/sub 1/-L/sub 2/-V) phase behaviour in CO/sub 2/-hydrocarbon systems is investigated using a combination of measurements of L/sub 1/-L/sub 2/ and L/sub 1/-L/sub 2/-V phase compositions and calculations of two- and three-phase behaviour with the Peng-Robinson equation of state (PREOS). New phase composition data are reported for mixtures of CO/sub 2/ with normal hexadecane (C/sub 16/) and squalane (C/sub 30/) and for mixtures of CO/sub 2/ with methane (C/sub 1/) and hexadecane. Measurements of three-phase pressures for mixtures of CO/sub 2/ with C/sub 14/, C/sub 16/ and C/sub 30/ are also reported. Calculations of L/sub 1/-L/sub 2/ and L/sub 1/-L/sub 2/-V phase behaviour with the PREOS are compared with all available experimental phase composition data for CO/sub 2/-C/sub 1/-C/sub 16/ and CO/sub 2/-propane (C/sub 3/)-C/sub 16/ systems. The PREOS is shown to predict such behaviour with reasonable quantitative accuracy if binary interaction parameters are selected to match L/sub 1/-L/sub 2/ data. Details of the disappearance of L/sub 1/-L/sub 2/-V behaviour with increasing temperature are investigated with the validated PREOS. For the CO/sub 2/-C/sub 3/-C/sub 16/ system, three-phase behaviour disappears at a tricritical point. For the CO/sub 2/-C/sub 1/-C/sub 16/ system, the disappearance occurs at the upper critical end point (UCEP) for the CO/sub 2/-C/sub 16/ binary system. Finally, qualitative similarities between CO/sub 2/-crude oil systems and the ternary systems described here are discussed.

8882 **Mixing during two-phase, steady-state laboratory displacements in sandstone cores.** Bretz, R.E.; Welch, S.L.; Morrow, N.R.; Orr, F.M. Jr. Richardson, TX; Society of Petroleum Engineers (1986). 16p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

This paper examines the changes in fluid distributions and the mixing that occurs in immiscible phases flowing in a porous medium with changes in phase saturations and flow rates. The authors report experimental results for steady-state displacements with saturations established by secondary drainage, for one outcrop and one reservoir sandstone. Displacements were performed using immiscible liquids of matched density and viscosity at six saturations ranging from residual oil to low initial water saturation. Flow rates at a given saturation were usually varied by more than an order of magnitude. The differences in displacement results between the two core samples are interpreted in terms of pore structure and changes in fluid distribution with changes in saturation and flow rate. The authors discuss the implications of the mixing results for the performance of EOR processes.

8883 **Formation of surface films at a sea ice/steel interface under impressed current conditions.** Sackinger, W.M.; Feyk, G.; Borchert, M.A. (Geophysical Institute, Univ. of Alaska, Fairbanks, AK 99775-0800). pp 24 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Discovery of oil in the Beaufort and Chukchi Seas will most likely be followed by the emplacement of offshore oil platforms in those areas where the water depth does not permit the use of gravel island technology. These oil platforms will be constructed using steel and perhaps concrete that has been designed to withstand arctic conditions. To protect the steel components of these structures from corrosion, a cathodic protection system will most likely be employed. The effectiveness of cathodic protection under arctic conditions is affected by the presence of sea ice rubble adjacent to the structures, which may be up to 30 meters in thickness. An investigation was conducted to determine the nature of the products that form on the surface of steel when current is injected into it from adjacent sea ice. The following is a summary of the results of this investigation: 1) The spatial extent of corrosion was reduced at high impressed current densities. 2) The most extensive corrosion takes place near the top surface of the sea ice. 3) The surface layers that form on the steel are composed of either oxides, carbonates, or chlorides that have precipitated from the sea ice brine. 4) The surface layers that form on the steel provide negligible resistance to the passage of electric current from the adjacent ice.

0204 Processing

REFER ALSO TO CITATION(S) 8833, 9365

8884 **(BMFT-FB-T—86-064) Non-catalytic hydrogen transfer in the upgrading of crude oil residue. Final report.** Kaempf, R.; Simo, T. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1986. 74p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750792.

The upgrading of paraffinic and mixed-base crude residue has been studied by means of Donor Solvent Hydrovisbreaking. Donor Solvent was prepared in internal recycle in a dual-stage catalytic hydrogenation from the upgrading product of Arab light vacuum residuum. The influence of the Donor Solvent/crude residuum ratio on the characteristics of the Donor Solvent Hydrovisbreaking was determined. Technically relevant conditions of the Hydrovisbreaking were realized in an isothermic recycle reactor in bench scale. Residue conversions up to 95% were achieved. The isothermic reaction system is to be demonstrated on a pilot scale. With 4 tabs., 20 figs.

8885 **(BMFT-FB-T—86-068) Hydropyrolysis of oils with heat generation by partial combustion. Final report.** Hedden, K.; Gauss, M.; Rieger, R.; Weitkamp, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1986. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750793.

Hydropyrolysis or, synonymously, thermal hydrocracking is a route of heavy oil conversion which is presently under development in several process variants. The main features of the hydropyrolysis reactor developed in this project are the atomization of the oil into an empty tube and generation of the heat by partial combustion of the reactants with oxygen inside the reactor. A pilot plant for oil throughputs up to 3 kg/h and pressures up to 20 bar was built. The burner and the arrangement of the nozzle were modified several times. It could be shown that it is desirable to separate the combustion zone from the cracking zone, in order to enable a stable operation and to improve the yields of useful products. Initially, n-hexadecane was employed as a model oil, later an atmospheric residue was used as feed. The oxygen throughput and, hence, reaction temperature markedly influenced the conversion. Gaseous hydrocarbons are the predominant products from hexadecane. With the residue feed, the yields of desired liquid products are higher. With appropriate constructions of the burner, the formation of coke can be avoided. With 38 refs., 16 tabs., 41 figs.

8886 **Breaking middle phase emulsions.** Clampitt, B.H.; Deysarkar, A.K.; Westmoreland, T.D. Jr. (to Pennzoil Co., Houston, TX). US Patent 4,623,447. 18 Nov 1986. Filed date 2 Aug 1985. v.p.

This patent describes a method for the separation and recovery of the water, oil and surfactants contained in a middle phase emulsion, which comprises distilling the emulsion under conditions of atmospheric distillation to separate the water from a residue comprising the oil and surfactant. The residue to vacuum distillation is subjected to separate the oil as a distillate and recover the surfactant as the distillation residue.

0205 Products And By-products

REFER ALSO TO CITATION(S) 9327, 9625

8887 **Sulfur-containing compositions, and additive concentrates and lubricating oils containing same.** Davis, K.E.; DiBiase, S.A. (to Lubrizol Corp., Wickliffe, OH). US Patent 4,623,473. 18 Nov 1986. Filed date 31 Jan 1985. v.p.

A lubricating oil composition comprising a major amount of an oil of lubricating viscosity and a minor, property improving amount of an oil-soluble composition which comprises (A) at least one metal salt of at least one dithiocarbamic acid of the formula R/sub 1/(R/sub 2/)N-CSSH wherein R/sub 1/ and R/sub 2/ are each independently hydrocarbyl groups in which the total number of carbon atoms in R/sub 1/ and R/sub 2/ is sufficient to render the metal salt oil-soluble, and (B) at least one oil-soluble sulfurized Diels-Alder adduct of at least one dienophile with at least one aliphatic conjugated diene. The weight ratio of (A) to (B) is in the range of from about 1:10 to about 50:1 and further wherein the lubricating oil composition contains less than about 0.1% by weight of phosphorous.

0206 Health And Safety

8888 (DOE/EIA—0109-86/09) Petroleum supply monthly, September 1986. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 20 Nov 1986. 108p. NTIS, PC A06/MF A01 - GPO; 1; GPO Dep. File Number DE87002881.

National statistics include crude oil and petroleum products; supply and disposition; imports; motor gasoline, distillate fuels, liquefied petroleum gases; residual fuel oils; production; and transport. (PSB)

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 9261, 9265, 9276

8889 (NP—7750804) Annual report 1985 submitted by the Austrian Petroleum Association. (Fachverband der Erdoelindustrie Oesterreichs, Vienna (Austria)). [1986]. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750804.

The report abstracted gives a brief summary of the national and international exploration and drilling activities of the Austrian petroleum industry and deals with the distribution and processing of petroleum and natural gas. Whereas 1985 yields have been slightly reduced compared with 1984, petroleum imports have been increasing for the first time since 1979. While natural gas imports have been increasing, natural gas production has also been experiencing cutbacks since 1984. The processing sector has seen a considerable growth in 1985. Tables serve to illustrate the development from 1981 to 1985. They also inform about petroleum product supplies and regional consumption or consumers, respectively. Moreover, the report discusses the activities of the petroleum association as well as 1985 events and their impact on the petroleum industry.

0208 Waste Management

REFER ALSO TO CITATION(S) 8850, 9693

0209 Environmental Aspects

8890 (EGG—10282-2123) Annual summary of endangered species preconstruction surveys conducted during 1985 on Naval Petroleum Reserve No. 1 (NPR-1), Kern County, California. Kato, T.T. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). Oct 1986. Contract AC08-83NV10282. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003165.

Preconstruction surveys were implemented as part of the US Department of Energy's compensation/mitigation plan to offset possible effects of petroleum developments on Naval Petroleum Reserve No. 1 on endangered species and their habitats. These surveys were conducted to gather information that could be used to assess potential impacts of construction activity on these endangered species and habitats and to formulate alternatives that resulted in avoiding or minimizing the effects. During 1985 a total of 128 preconstruction surveys were conducted covering approximately 457.5 acres of which approximately 300 acres were for long-term disturbances and approximately 157.5 acres were for superficial disturbances. The area surveyed during preconstruction surveys was usually larger than the actual area disturbed. A total of 37 kit fox dens, four culverts and two erosion gullies used by kit fox, and six blunt-nosed leopard lizard habitats were found. All of the dens and culverts threatened by construction were avoided by modifications at 11 project sites. Three of the four threatened blunt-nosed leopard lizard habitats were avoided by modifications at three project sites. No new construction projects on NPR-1 were completed before a preconstruction survey was conducted. Preconstruction surveys continued to be a useful tool to eliminate or minimize potential direct effects of construction activities on endangered species, proposed endangered species, and their habitats on NPR-1. 4 refs., 1 fig., 2 tabs.

0220 Transport, Pipelines, And Handling

8891 (AD-A—172472/3/XAB) Pipeline corrosion and friction reduction coatings. Final report. Galica, J.; Thoma, L. (Springborn Labs., Inc., Enfield, CT (USA)). Jun 1986. 50p. NTIS, PC A03/MF A01.

The objective of this program was to demonstrate the feasibility of coating tactical pipelines with coatings other than coal tar epoxy. These alternate coatings must be suitable for internal and external surfaces, provide corrosion protection and reduce friction when pumping fuel. Twenty-five commerically available coatings were evaluated for their corrosion protection and friction reduction characteristics. Of these coatings, seven were qualified through corrosion and adhesion evaluations. However, following frictional evaluations, only three of the seven are recommended. As a cost-effective means to improve commercially available coatings, two methods were examined to reduce friction coefficients. While these methods, which include coating reformulation with lubricating additives and surface fluorination, appear promising they will require substantial research and development efforts to optimize. Therefore, this program recommends three commerically available coatings as identified below for further evaluation: Glid-Guard Chemical Resistant Epoxy, Integral Fuel Tank Coating, and Dacromet 320 and Plus.

0230 Properties

REFER ALSO TO CITATION(S) 8887

0240 Storage

8892 (DOE/FE—0076) Strategic Petroleum Reserve: Quarterly report, July 1, 1986-September 30, 1986. (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Office of Petroleum Reserves). 15 Nov 1986. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003281.

This report describes activities undertaken with respect to the development of the Reserve during the period July 1, 1986 through September 30, 1986. The introduction and summary briefly discuss program background and major activities. Section II describes site development. Oil acquisition activities are reported in Section III. Other program topics are discussed in Section IV. Information on the budget and cost of the Reserve is contained in Section V. Strategic Petroleum Reserve capacity development continued. The total inventory of crude oil stored in the Strategic Petroleum Reserve reached 506,384,767 barrels. The average fill rate was 49,977 barrels per day, and the weighted average delivered price was $13.25 per barrel. The July 2, 1986, enactment of the Urgent Supplemental Appropriations Act, 1986 (P.L. 99-349) restored $619 million of funds which the Administration sought to defer. These funds included $41 million for the development, operation and management of the Reserve and $578 of SPR Petroleum Account funds. On October 18, 1986, the President signed the Continuing Resolution for fiscal year 1987 (P.L. 99-500), which provides $147.4 million of new budget authority in fiscal year 1987 for development, operations and management activities. On October 21, 1986, the President also signed the Omnibus Budget Reconciliation Act of 1986 (P.L. 99-509). This legislation requires that the Strategic Petroleum Reserve be filled at a minimum rate of 75,000 barrels a day until at least 750 million barrels are in storage, or the sale or other disposal of crude oil from the Naval Petroleum Reserve Number 1 is restricted. In addition, P.L. 99-509 expands the information required to be included in the annual report for the Strategic Petroleum Reserve.

0250 Combustion

REFER ALSO TO CITATION(S) 8833

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 8868, 8869, 9698

8893 **Development of slickline logging tools for very high-temperature applications.** Carson, C.C.; Wolfenbarger, F.M. Richardson, TX; Society of Petroleum Engineers (1986). 7p. (CONF-861080—). Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836. Contract AC04-76DP00789.

From Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (5 Oct 1986).

Five logging tools were developed for collecting data in the DOE-sponsored Salton Sea Scientific Drilling Project (SSSDP) well. The tools were designed to function at temperatures up to 400°C (752°F) and were successfully operated in the well at temperatures of 360°C (680°F). All of the tools--mechanical units for measuring and recording temperature, pressure, and flow rate; an electronic memory tool for measuring and recording temperature and pressure; and a special purpose battery pack for powering a downhole fluid sampler--are designed for slickline operation. In each, selected critical components are places inside a dewar that provides thermal protection for a limited time. This paper discusses the tools, their development and operation, the results from their use in the SSSDP well, and potential extensions to geothermal and gas well applications.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 8871, 8878, 8880

8894 **Utilizing the mehra process for processing and btu upgrading of nitrogen-rich natural gas streams.** Mehra, Y.R. (to El Paso Hydrocarbons Co., Odessa, TX). US Patent 4,623,371. 18 Nov 1986. Filed date 26 Jul 1985. v.p.

A process is described for separating C/sub 1/ + hydrocarbons and nitrogen from a nitrogen-rich natural gas stream which contains more than 3 mol % of the nitrogen, comprising the following steps: A. extracting the natural gas stream with a physical solvent to produce a nitrogen stream and a methane-rich solvent stream; B. flashing the solvent stream at a flashing pressure which is selected to be in between 1300 psia and 2 psia and is sufficiently low that substantially all the C/sub 1/ + hydrocarbons are separated from a stripped solvent stream and are produced as a stream of flashed-off gases; and C. recycling the stripped solvent stream to the extracting of the Step A.

0304 Products And By-products

REFER ALSO TO CITATION(S) 9029

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 8889, 8897

8895 **(DOE/EIA—0130(86/09)) Natural gas monthly: September 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 1 Dec 1986. 160p. NTIS, PC A08/MF A01 - GPO; 1; GPO Dep. File Number DE87003336.

Current data on natural and supplemental gas consumption, disposition, production, prices, storage, imports, and exports in the United States are provided for each year from 1980 through October 1986, with monthly data for the most recent 3 years. Some data are also given by state or city; some data are also given for previous years. Operating and financial data for major interstate natural gas pipeline companies, as well as data on filings, ceiling prices, and transportation under the Natural Gas Policy Act of 1978, are also included. Explanatory notes, a discussion of data sources, and a glossary are included. Three reports previously published as separate annuals are now published in this report. The three are: "Underground Natural Gas Storage in the United States" (DOE/EIA-0239), "US Imports and Exports of Natural Gas" (DOE/EIA-0188), and "Main Line Sales of Natural Gas to Industrial Users" (DOE/EIA-0129). 6 figs., 33 tabs.

8896 **(GRI—86/0132) Competitive position of natural gas: Steel reheat applications: Topical report.** Williams, J.H.; Koch, G.S.; McDermott, H.; Klareich, F.H. (Hagler, Bailly and Co., Washington, DC (USA)). Aug 1986. 160p. NTIS, PC A08/MF A01. File Number TI87900251.

Natural gas is by far the preferred fuel for steel reheat applications, accounting for approximately 135 x 10^{12} Btu per year of a 187 x 10^{12} Btu per year total reheat fuels market based on 1984 production figures. However, changes in the steel industry over the next 20 years could substantially reduce the traditional steel reheat market and affect the competitiveness of present natural gas-fueled technologies. Process innovations such as hot charging, direct rolling, thin slab and thin strip casting, and powdered metals are being pursued by both mini-mill and integrated producers. Each of these processes reduce or eliminate the need for reheat. When reheat is needed, the process usually requires much less fuel, as well as an ability to rapidly reheat thin products in a continuous, lower-scale-loss reheat cycle than can be provided by conventional gas furnaces. Therefore, new gas-fired rapid heating technologies will need to be developed if gas is to remain competitive with electric induction systems that offer relatively fast and low-scale-loss reheat cycles. The changing structure of the steel industry will also affect the use of natural gas for reheat applications, as the domestic steel industry is downsized over the next few years. Also, the relative share of mini-mill production is expected to continue to grow, especially if mini-mills are able to capture part of the sheet market, which now represents 67% of integrated mill shipments. In comparison to integrated mills, mini-mills are more likely to adopt hot charging, direct rolling, thin steel casting, and other new technologies that minimize steel reheat needs. This study provides insights into the technological and important factors influencing the reheat future competitiveness of natural gas-fueled reheat furnaces. 59 refs., 19 figs., 38 tabs.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 8891

8897 **(DOE/EIA—0167(85)) Gas supplies of interstate natural gas pipeline companies 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 14 Nov 1986. 133p. NTIS, PC A07/MF A01 - GPO; 1; GPO Dep. File Number DE87003338.

This publication provides information on the total reserves, production, and deliverability capabilities of the 91 interstate pipeline companies. The gas supplies of interstate pipeline companies consist of the certificated, dedicated, recoverable, salable natural gas available from domestic in-the-ground reserves; gas purchased under contracts with other interstate pipeline companies; domestically produced coal gas, liquefied natural gas (LNG), and synthetic natural gas (SNG); and imported natural gas and LNG. The domestic in-the-ground reserves consist of company owned reserves including natural gas in underground storage, reserves dedicated to or warranted under contracts with independent producers, and supplemental or short-term supplies purchased from independent producers and intrastate pipeline companies. To avoid duplicate reporting of domestic in-the-ground reserves, the volumes of gas under contract agreement between jurisdictional pipelines have been excluded in summarizing state and national reserves. Volumes contracted under agreements with foreign suppliers include pipeline imports from Canada and Mexico and LNG from Algeria. 7 figs., 18 tabs.

8898 A molecular composite route to processing: Property relationships for polyethylene pipe. Kardos, J.L.; Powell, R.L.; Jerina, K.L.; Chen, Y. (Materials Research Lab., Washington Univ., St. Louis, MO). pp 14-19 of Proceedings of the eighth plastic fuel gas pipe symposium. Arlington, VA; American Gas Association (1983). (CONF-8311290—).

From 8. plastic fuel gas pipe symposium; New Orleans, LA, USA (29 Nov 1983).

Molecular composite models describing both isotropic and anisotropic bulk sheets were refined for polyethylene and computerized to produce three-dimensional plots in which the in-plane tensile stiffnesses were shown as functions of various binary combinations of volume fraction crystallinity, amorphous phase (matrix) modulus, crystallite aspect ratios, and degree of orientation. Similar plots were also developed for the yield strength of isotropic sheets. These plots showed that different aspect ratio combinations (and therefore different processing conditions) are needed for maximizing stiffness than for maximizing yield strength. Furthermore, orienting the lamellar crystallites achieves only limited stiffness and strength improvement. To further enhance such improvements, the basic folded-chain lamellar crystallite morphology must be modified.

04 OIL SHALES AND TAR SANDS

0403 Drilling, Fracturing, And Mining

8899 (SAND—86-1762) Oil Shale Program: Quarterly reports, April 1985-September 1985. Hommert, P.J. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002729.

The topics in this quarterly primarily deal with the area of rock fragmentation and rock motion. The rock fragmentation review panel meeting held in May 1985 is summarized. The experimental plans for future field experiments in oil shale fragmentation are discussed in detail. This includes outlining the sequence of experiments that are necessary to confirm the predictive capability for oil shale fragmentation. It also involves a progression from single blastwell tests through confined volume multi-blastwell tests. As part of the overall experimental effort, work conducted during this period to improve our ability to measure explosive gas pressure is discussed. A series of studies that use the DAMAGE model in the code DYNA2D were conducted during this quarterly period to improve our understanding of the validity and sensitivity of our approach to calculating fracture. One study focused on the sensitivity of predicted fracture to the various mechanical properties of the rock. The most significant sensitivity observed was that of total predicted volume of fractured rock to Poisson's ratio. This highlights the need to accurately know this particular rock property before making predictions. The study also closely examined what has appeared to be anomalous regions of predicted unfractured rock near the explosive borehole. Finally, this report discusses the continued development of the CAROM model, particularly the relationship between the coefficient of restitution and the number of fragments in a computational element. This also explains differences observed in depth-of-pull in experimental cratering shots where the only difference is fragment size. 19 refs., 32 figs.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 8899, 8901

8900 Upgrading shale oil by a combination process. Che, S.C.; Madgavkar, A. (to Occidental Oil Shale, Inc., Grand Junction, CO). US Patent 4,623,444. 18 Nov 1986. Filed date 27 Jun 1985. v.p.

A process is described for upgrading a shale oil feed containing lighter shale oil compounds including lighter shale oil compounds containing nitrogen and heavier shale oil compounds including heavier shale oil compounds containing nitrogen comprising the steps of: heating the shale oil feed sufficiently to vaporize lighter shale oil compounds; condensing the vaporized lighter shale oil compounds in a number of consecutively collected fractions; separately reducing the nitrogen content of each collected fraction by the steps of: mixing the collected fraction with an extraction agent capable of selectively extracting lighter shale oil compounds containing nitrogen from the collected fraction for a time sufficient to form a nitrogen-rich extract.

0409 Waste Research And Management

8901 Polymer flotation and activated carbon adsorption treatment for in situ tar sand process water. McTernan, W.F.; Blanton, W.E.; Boardman, G.D.; Nolan, B.T.; Kocornik, D.J. (School of Civil Engineering, Oklahoma State Univ., Stillwater, OK 74078). *Environmental Professional, The;* **5**: No. 3, 154-158(1986).

Process waters collected during a Department of Energy's in situ tar sand extraction experiment near Vernal, Utah were treated by polymer assisted induced air flotation and activated carbon adsorption. The flotation process removed over 99 percent of the organic load as emulsified bitumen but did little to reduce residual toxicity in the effluents. Activated carbon adsorption was needed to remove the toxic materials from the waste stream. GC/MS analysis, using a modification of the EPA Method 625, yielded an estimated 2000 compounds in the untreated process water. Internal and recovery standards present at 10 ppm were totally obscured in the chromatogram. Flotation effluents contained 39 identified organic compounds; none of which was listed on EPA's hazardous chemicals list. Internal and recovery standards were immediately visible in the chromatogram. The GC/MS analysis was unable to determine the chemical basis for the toxic properties present.

05 NUCLEAR FUELS

0501 Reserves, Exploration, And Mining

8902 (PNCT-N—433-84-01) Present status of uranium resource development in foreign countries, 1984. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Dec 1984. 254p. (In Japanese). NTIS (US Sales Only), PC A12/MF A01. File Number DE87700266.

The book of the same title as this one was published in 1983. Since then, the situation requiring the correction of the contents, such as the correction of uranium resource policy in various countries accompanying the change of uranium market conditions and the change of uranium policy in Australia due to the political situation, has occurred, consequently, the revision has been made adding this new information. The confirmed resources of uranium and the resources of uranium to be added by estimation in the free world are tabulated. About each country, the organization and policy, the policy of exporting uranium and the present status of the export, the quantity of uranium resources, the production of uranium, the state of exploration and development and so on are reported. Japan has taken part in the development of uranium resources in Australia, Canada, Gabon, Zambia, Morocco, Guinea, Mali and so on.

0504 Feed Processing

REFER ALSO TO CITATION(S) 8932, 9011

8903 (K/TR—86/14) Preparation of UF$_4$ (single step reduction of UF$_6$ with H$_2$/F$_2$). Jang, I.S. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1986. Contract AC05-84OT21400. Translation of KAERI/RR-456/84, January 1985. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002797.

The uranium tetrafluoride (UF$_4$) has been prepared via a single step reduction of uranium hexafluoride (UF$_6$) with hydrogen and fluorine gases in the cold wall reactor. The tap density and shape of the UF$_4$ powder are largely dependent on the nozzles used, either concentric nozzle or the nozzle separated. The round shape of dense UF_4 powder is obtained by adding of hydrogen gas and UF_6-F_2 gaseous mixture through the nozzle separated. Feeding rate, ratio of three gases and preheating temperature have also a marked effect upon the its density and particle size. The specification of the UF_4 product obtained using the nozzle separated in the cold wall reactor are well met on the preparation of uranium metal using UF_4 and magnesium powder.

0505 Uranium Enrichment

REFER ALSO TO CITATION(S) 9014, 9015, 9085, 10671

8904 (INIS-mf—10311) **Current status of uranium enrichment by way of chemical exchange reactions.** El Basyouny, A.; Bechthold, H.C.; Knoechel, A.; Vollmer, H.J. (Hamburg Univ. (Germany, F.R.). Inst. fuer Anorganische und Angewandte Chemie). Apr 1985. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750324.

For this report, conference proceedings, patents and other types of literature have been collected to present an account of the current status of uranium enrichment by way of chemical exchange reactions. The report further presents a new concept along with the relevant process strategy developed by the authors. The principal process of the new concept is a chemical exchange process with crown ethers, complexed or free, playing an important part in the reactions. The authors also describe their experiments carried out for establishing suitable chemical systems.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 9011

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 9503

8905 (CEA-CONF—8367) **Spent fuel management in France.** Guillemard, B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1986. 21p. (CONF-8603158—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750718.

From IAEA expert meeting on spent fuel management; Vienna, Austria (10 Mar 1986).

Spent fuel management in France is characterized by the reprocessing option; reprocessing being one of the major nuclear fuel industries developed to keep pace with the upgrowth of the national nuclear power program based on light water reactors and subsequently on fast breeder reactors. France has launched two industrial projects which will raise the annual reprocessing capacity of La Hague facility to 1600t of water reactor irradiated fuel, based on reprocessing experience and R and D work: - the UP3 plant (800t/year) which will be commissioned in 1989 - the UP2 800 plant, an extension of the existing plant, which will be commissioned in 1991. R and D work is also in progress, together with the extension of the Marcoule Pilot Plant (TOR project), and preparations made for the industrial reprocessing of fuel from the Super Phenix reactor and the first fast breeder reactors (MAR 600 project). 30 refs.

8906 (CEA-CONF—8402) **Technetium behaviour control in the purex process.** Vialard, E.; Germain, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Sep 1986. 7p. (CONF-860921—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750716.

From ISEC '86: international solvent extraction conference; Munich, F.R. Germany (11 Sep 1986).

Technetium has been neglected for a long time in reprocessing nuclear fuels, but recent studies have emphasized its anomalous behaviour: it is fairly extracted by TBP and it catalyses hydrazine decomposition by nitric acid. With today's increased burn-up fuels a low technetium decontamination factor is expected and reoxidation risks are enhanced in the uranium-plutonium partition. This paper deals with an examination of technetium behaviour and an attempt to limit the risks using slight modifications of the flowsheets.

8907 (ORNL/tr—86/59) **Brief description of the Wackersdorf Reprocessing Facility.** (Oak Ridge National Lab., TN (USA); Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). 1986. Contract AC05-84OR21400. Translation source information not available . 173p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87003175.

The DWK is now planning the construction and operation of a facility for the reprocessing of spent fuel elements and the fabrication of mixed-oxide fuel elements which will initially have an average daily throughput of 2 tons (t) of nuclear fuel. The application required by the Atomic Law was submitted to the Bavarian State Ministry for State Development and Environmental Matters on October 28, 1982. According to Par. 3, Section 1, No. 1 of the Atomic Law Procedural Ordinance such an application for permission in accordance with par. 7 AtL must explicitly be accompanied by a safety report which shall make it possible for third parties to make a judgment whether the impacts associated with the facility and its operation could damage their rights. The safety report is intended to present and explain the concept of the facility, the safety-technological design bases, and the operation of the plant, including its operation and safety systems and the impacts and proposed preventive measures. In addition to the detailed presentations in the safety report, Par. 3 of the Atomic Law Procedural Ordinance also requires a brief description of the plant designed for general public understanding, suitable for the design, which will also explain the expected impacts on the general environment and the surrounding area. Hence the brief description presents and explains the following matters: the site; the technology and state of the art for reprocessing of spent nuclear fuel; the structure and function of the proposed facility; safety provisions of the proposed facility and the management of perturbations in operation; the impacts of the facility and its operation on the environment; measures to be taken for dealing with the radioactive wastes; and provisions for ultimate shut-down of the facility.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 9635, 10052, 10053, 10054, 10055

8908 (DOE/AL/33218—T6) **[Analysis of transportation issues: Seventh bi-monthly report of activities].** (Western Interstate Energy Board, Denver, CO (USA)). 25 Nov 1986. Contract AC02-85AL33218. 15p. NTIS, PC A02. File Number DE87002719.

The contract requires the completion of eight tasks: Task I - updates to the "Primer"; Task II - in-depth analysis of previously identified issues; Task III - identification of factors to be considered in route-specific analyses; Task IV - identification of data for route-specific analyses; Task V - state comments on the Transportation Institutional Plan; Task VI - report on activities over the past year; Task VII - conduct two meetings and record minutes; and Task VIII - meeting with DOE at the end of the first year's effort to explore needed redirection of the effort. During the past two months, the contractor has spent most of its effort on Tasks II, VI, and VIII. The status of each task is given.

8909 (DOE/RW—0120) **Implementation plan for deployment of Federal Interim Storage facilities for commercial spent nuclear fuel.** 951 7735. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Dec 1986. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003680.

This document is the third annual report on plans for providing Federal Interim Storage (FIS) capacity. References are made to the first and second annual reports, as necessary. Background factors and aspects that were considered in the development of this deployment plan and activities and interactions considered to be required to implement an FIS program are discussed. A generic description of the approach that the Department plans to follow in deploying FIS facilities is also described.

8910 (EPRI-NP—4887) **The CASTOR-V/21 PWR spent-fuel storage cask: Testing and analyses: Interim report.** Dziadosz, D.; Moore, E.V.; Creer, J.M.; McCann, R.A.; McKinnon, M.A.; Tanner, J.E.; Gilbert, E.R.; Goodman, R.L.; Schoonen, D.H.; Jensen, M. (Virginia Power Co., Richmond (USA); Pacific Northwest Lab., Richland, WA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1986. Contract AC06-76RL01830. 248p. (PNL—5917). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE87003329.

A performance test of a Gesellschaft fuer Nuklear Service CASTOR-V/21 pressurized water reactor (PWR) spent fuel storage cask was performed. The test was the first of a series of cask performance tests planned under a cooperative agreement between Virginia Power and the US Department of Energy. The performance test consisted of loading the CASTOR-V/21 cask with 21 PWR spent fuel assemblies from Virginia Power's Surry reactor. Cask surface and fuel assembly guide tube temperatures, and cask surface gamma and neutron dose rates were measured. Testing was performed with vacuum, nitrogen, and helium backfill environments in both vertical and horizontal cask orientations. Limited spent fuel integrity data were also obtained. Results of the performance test indicate the CASTOR-V/21 cask exhibited exceptionally good heat transfer performance which exceeded design expectations. Peak cladding temperatures with helium and nitrogen backfills in a vertical cast orientation and with helium in a horizontal orientation were less than the allowable of 380°C with a total cask heat load of 28 kW. Significant convection heat transfer was present in vertical nitrogen and helium test runs as indicated by peak temperatures occurring in the upper regions of the fuel assemblies. Pretest temperature predictions of the HYDRA heat transfer computer program were in good agreement with test data, and post-test predictions agreed exceptionally well (25°C) with data. Cask surface gamma and neutron dose rates were measured to be less than the design goal of 200 mrem/h. Localized peaks as high as 163 mrem/h were measured on the side of the cask, but peak dose rates of <75 mrem/h can easily be achieved with minor refinements to the gamma shielding design. From both heat transfer and shielding perspectives, the CASTOR-V/21 cask can, with minor refinements, be effectively implemented at reactor sites and central storage facilities for safe storage of spent fuel.

8911 (IAEA-TECDOC—375) **International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.** (International Atomic Energy Agency, Vienna (Austria)). May 1986. 133p. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

The Agency approved the Coordinated Research Programme on Safe Transport of Radioactive Materials in September 1979, and the first research agreement pertaining to the programme was finalized in February 1980. Through the end of the programme, it involved three research contracts and eight research agreements. The present document contains final summary reports on the activities performed during the entire coordinated research programme, from its inception in 1980, through two intermediate Research Coordination Meetings in Albuquerque, USA, June 1981, and in Rome, Italy, March 1983, to its concluding Research Coordination Meeting in London, UK, July 1985.

8912 (IAEA-TECDOC—375, pp 23-32) **Radioactive material transport package activity release limits.** MacDonald, H.F.; Goldfinch, E.P. (Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.; Central Electricity Generating Board, Health and Safety Dept., London, UK). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

The initial phase of work under this Research Agreement was devoted to an assessment of the individual and collective doses associated with the routine transport of irradiated fuel from commercial nuclear power stations in the UK. The levels of radiation dose involved to both transport workers and members of the public were shown to be low in comparison with statutory limits and with other sources of dose arising in the nuclear fuel cycle. In addition, the dosimetric implications of the Type B package activity release limits contained in the 1973 IAEA Transport Regulations were examined. It was shown that the Type B(U) limit under accident conditions appeared unduly restrictive in comparison with safety standards commonly applied at power reactor sites and in the 1985 revised Regulations this limit is relaxed such that the earlier Type B(M) limit is now applied to all Type B packages. Also, methods of evaluating the radioactive source term in transport accident assessments were considered. The later phases of this work were concerned with the development of the Q system which is a refinement and extension of the earlier A_1/A_2 system for the determination of Type A package contents and other limits within the IAEA Transport Regulations. Following review by a Special Working Group meeting convened by the Agency, the Q system was adopted for inclusion in the 1985 revised Regulations and will be fully described in the revised version of Safety Series No. 7. It incorporates the latest recommendations of the ICRP and by explicitly identifying the dosimetric considerations underlying the derivation of the A_1 and A_2 values provides a firmer and more defensible basis for the Regulations. Overall, the adoption of the Q system has introduced only relatively minor variations in the A_1 and A_2 values compared with those of the 1973 Regulations. 10 refs, 6 figs.

8913 (IAEA-TECDOC—375, pp 77-83) **World-wide risk assessment of the transportation of radioactive materials.** Ericsson, A.M.; Elert, M.; Ek, P.; Dufva, B.; Pettersson, B. (Kemakta Konsult AB, Stockholm, Sweden; Swedish Nuclear Power Inspectorate, Stockholm). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

The aim of the project reported in this paper is to develop the means and methods for a risk analysis of the transportation of radioactive materials throughout the world. The project was initiated by the Standing Advisory Group on the Safe Transport of Radioactive Materials (SAGSTRAM) of the IAEA. In 1979 the Swedish Nuclear Power Inspectorate and the IAEA signed an agreement on the development of a model for calculation of the transport risk. Member States of the IAEA are invited to use the model for a risk assessment of the transportation of radioactive materials in their own country. These assessments will be collected and analyzed and a world-wide risk assessment performed. The IAEA has the overall responsibility for the project and administers it. Sweden manages the project and has performed the applied research with the assistance of research support groups which have supplied data and analyses and performed some other parts of the project. An Oversight Committee with participants from eight Member States has reviewed the progress and has given valuable recommendations. It was important that the model had the sophistication and flexibility required for its use by all Member States but still was easy to handle. The risk calculations are performed by the computer code INTERTRAN [1,2] which is based on the American computer code RADTRAN II developed by Sandia National Laboratories, Albuquerque, NM [3]. The methodology of the RADTRAN II as well as data and format of the input and output was changed to make the code more internationally oriented. 3 refs, 1 fig.

8914 (IAEA-TECDOC—375, pp 105-108) **Development of generic risk assessment code for radioactive material transportation.** Luna, R.E. (Sandia National Labs., Albuquerque, NM, USA). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

The Coordinated Research Programme agreement with the US (at Sandia National Laboratories) covered support of the development of INTERTRAN, development of risk assessment techniques and support of Member States' efforts to use INTERTRAN. While there were no requests made to Sandia for member support under the last item, significant activities were undertaken and completed to support the initial two items. Since INTERTRAN is an outgrowth of RADTRAN, US activities to expand and improve RADTRAN are likely applicable to INTERTRAN. Such activities included: correction of on-leak doses, improving stop models for truck and rail, including ingestion doses, modelling multiple package movements and compiling a probability-consequence spectrum to aid in accident risk interpretation. In addition, the concept of unit risk factor (URF) as a simplifying concept which is applicable to simple risk estimation problems or multiple evaluation under different conditions has been pursued. In the URF technique the approximate risk is determined from total miles and total shipments through a URF calculated for the problem or otherwise available that converts shipment-kilometres to risk units. The technique can be applied both to normal and accident situations. In concept the URF is not unlike published accident rates, e.g., fatalities/10^8 vehicle miles which are based on occurrence of death on highways or railroads. The risk methods developed have been used for a variety of purposes in the US and several are highlighted specifically supporting the environmental assessments for The Nuclear Waste Policy Act. These analyses include Cost Risk I and II and a paper which shows the sensitivity of spent fuel shipment risk assessment to variations in input parameters. It is expected that the US efforts will be reflected in both the future use and usability of INTERTRAN and further the IAEA's policy of increasing transport risk assessment activities of its members. 5 refs.

8915 (IAEA-TECDOC—375, pp 119-126) **Evaluating risk in transport of tritiated water.** Palacios, E.; Biaggio, A.L.; Menossi, C.A.; Segado, R.C.; Reyes, R. (Comision Nacional de Energia Atomica, Buenos Aires, Argentina). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

This report responds to IAEA's Research Agreement 3073/R1/CF on evaluating risk in transport of tritiated water and summarizes a quantitative acceptation criterion based on the limitation of individual risk. Full load transport situations have been taken into account, while accidental spill cases occurring indoors or in transitory storages were disregarded. The fundamentals of the acceptation criterion applied in Argentina for evaluating accidental situations in nuclear power plants (NPPs) have been extended to the cases involving the transport of tritiated water. The resulting doses per unit of tritium concentration are evaluated for different accidental situations and a hypothetical example of application of the acceptation criterion is developed. 14 refs, 3 figs, 3 tabs.

8916 (INIS-mf—10514, pp vp) **Broad survey of radioactive waste transport and trends.** Blum, P.T. (Transnucleaire, 75 - Paris, France). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8917 (INIS-mf—10514, pp vp) **Modelling radioactive transport in a porous medium.** Botha, J.F. (University of the Orange Free State, Bloemfontein, South Africa. Inst. for Ground Water Studies). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8918 (INIS-mf—10514, pp vp) **Dry storage of light water reactor fuel.** Cumiskey, J.; Cardito, J.; Bushnell, G.; Popper, S. (Stone and Webster Engineering Corp., Boston, MA, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8919 (INIS-mf—10514, pp vp) **Long-term interim storage of spent fuel - approved technology for economical concepts.** Kirchenmayer, A.; Banck, J.; Wasinger, K. (Kraftwerk Union A.G., Offenbach am Main, Germany, F.R.). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8920 (PNL—5944) **MONITOR: A computer model for estimating the costs of an integral monitored retrievable storage facility.** Reimus, P.W.; Sevigny, N.L.; Schutz, M.E.; Heller, R.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003599.

The MONITOR model is a FORTRAN 77 based computer code that provides parametric life-cycle cost estimates for a monitored retrievable storage (MRS) facility. MONITOR is very flexible in that it can estimate the costs of an MRS facility operating under almost any conceivable nuclear waste logistics scenario. The model can also accommodate input data of varying degrees of complexity and detail (ranging from very simple to more complex) which makes it ideal for use in the MRS program, where new designs and new cost data are frequently offered for consideration. MONITOR can be run as an independent program, or it can be interfaced with the Waste System Transportation and Economic Simulation (WASTES) model, a program that simulates the movement of waste through a complete nuclear waste disposal system. The WASTES model drives the MONITOR model by providing it with the annual quantities of waste that are received, stored, and shipped at the MRS facility. Three runs of MONITOR are documented in this report. Two of the runs are for Version 1 of the MONITOR code. A simulation which uses the costs developed by the Ralph M. Parsons Company in the 2A (backup) version of the MRS cost estimate. In one of these runs MONITOR was run as an independent model, and in the other run MONITOR was run using an input file generated by the WASTES model. The two runs correspond to identical cases, and the fact that they gave identical results verified that the code performed the same calculations in both modes of operation. The third run was made for Version 2 of the MONITOR code. A simulation which uses the costs developed by the Ralph M. Parsons Company in the 2B (integral) version of the MRS cost estimate. This run was made with MONITOR being run as an independent model. The results of several cases have been verified by hand calculations.

8921 (REG/G—344-Rev.2) **Proposed revision 2 to regulatory guide 3.44: Standard format and content for the safety analysis report for an independent spent fuel storage installation (water-basin type).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Nov 1986. 111p. Nuclear Regulatory Commission, Washington, DC 20555. File Number TI87900157.

The Nuclear Regulatory Commission has published a proposed Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste." All references to Part 72 in this draft regulatory guide refer to this proposed version that was published for comment in the Federal Register on May 27, 1986 (51 FR 19106). The proposed Part 72 specifies the information to be supplied in applications for licenses to store spent fuel in an independent spent fuel storage installation (ISFSI). However, Part 72 does not specify the format for the safety analysis report (SAR). This regulatory guide provides guidance on preparing an SAR, and the NRC staff suggests its use for presenting the required information. Chapters are devoted to site characteristics, principal design criteria installation design, operation systems, site-generated waste confinement and managment, radiation protection, accident analyses, conduct of operations, and operating controls and limits.

0510 Marketing, Economics, And By-products

REFER ALSO TO CITATION(S) 8928, 9248

0520 Waste Management

REFER ALSO TO CITATION(S) 8991, 8993, 8994, 8995, 8996, 8997, 8998, 8999, 9000, 9003, 9004, 9005, 9006, 9007, 9085, 9251, 9252, 9404, 9405, 9407, 9442, 9489, 9942, 9952, 9977, 9998, 10004, 10005, 10090, 10091, 10092, 10093, 10094, 10095, 10098, 10107, 10108, 10113, 10624

8922 **(AECL—8827) Mathematical model, and code LIXY, for leaching of radionuclides from containment.** Fraser, J.L.; Jarvis, R.G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700292.

A mathematical model has been developed to describe the leaching of a radionuclide from an inner region into an outer region, by diffusion processes. Answers have been obtained for the whole range of time values, and have been written into a code LIXY, to calculate the concentration of nuclide at the outer face of the outer region.

8923 **(AECL—8828) Mathematical model, and code HADES, for migration of radionuclides from a shallow repository.** Fraser, J.L.; Jarvis, R.G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Waterloo Univ., Ontario (Canada)). Jun 1985. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700293.

The mathematical model is one-dimensional, to describe migration of radionuclides, by diffusion and advection, through several consecutive layers that can represent vault materials and surrounding ground. The solutions are evaluated by a computer code HADES.

8924 **(BNL—38903) Development of a computerized data base for low-level waste leaching data.** Dougherty, D.R.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). Sep 1986. Contract AC02-76CH00016. 13p. (CONF-860990—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003210.

From 8. annual participants' information meeting of the DOE Low-Level Waste Management Program; Denver, CO, USA (22 Sep 1986).

A computerized data base of low-level waste (LLW) leaching data is being compiled by Brookhaven National Laboratory. Although this data base is being compiled as part of an effort to develop accelerated leach test procedures for LLW forms, others involved in LLW management may find it useful. The data base is implemented on an IBM PC XT and is self-contained in that its data manipulation and analysis programs are not proprietary (i.e., need not be purchased). The data base includes data from the Accelerated Leach Test(s) Program plus selected literature data, which have been selected based on criteria that include completeness of the experimental description and elucidation of leaching mechanisms.

8925 **(CEA-CONF—8417) Immobilization of low and medium level radioactive waste with polymers. Last developments in France.** Vidal, H.; Buzonniere, M. de. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 26p. (CONF-8604261—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750240.

From AIEA technical meeting; Rome, Italy (14 Apr 1986).

The epoxy process for embedding spent ion exchange resins and evaporator bottoms from power plants is examined in this paper. Dried or dripped wastes, including soda pretreatment for ion exchange resins, are mixed with epoxy in 200 l drums, after polymerization package is transferred in a steel container for storage. Results of development of this process in chemical and technological field are reported. By modifications of epoxy formulation the following objectives have been reached: use of embedding products free from volatile solvent, elimination of neutralization pretreatment, polymerization independent of waste acidity, and possibility of embedding high humidity. Main properties of final products are examined.

8926 **(CEA-DAS—121) Modelling study of transfer phenomena related to a storage site at various stages in the site life.** Goblet, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete; Ecole Nationale Superieure des Mines de Paris, 77 - Fontainebleau (France). Centre d'Information Geologique). 1984. 25p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750269.

The available data for a modelling exercise related to the Auriat site have been analysed. The possibility of a 3 dimensional model of the rock mass was first assessed. The behaviour of the water-bearing, alterated upper part of the granite proved to be difficult to model except on a global way, by lack of qualitative description of the aquifer, as well as of sufficiently long series of flow rate measurements, or of piezometric head maps. We have therefore chosen a vertical 2D model, representing a cross section of the rock mass, to test the influence of the conductivity field on the flow pattern. This cross section covers 13.5 km horizontally, between two major outlets (la Maulde and la Vige). It extends vertically down to -2000 m. The conductivity data were obtained from the deep borehole measurements, and extended horizontally to the whole section. Several variations were made to account for the uncertainty in the measurements and to study the influcence of major fracture zones. Preliminary results emphasize the role of surface conditions and of the conductivity field. They show the necessity of additional modes of characterization of the medium (flowlines, residence times, flow rate profiles) which will be included later on. From these elements we intend to propose a position for a potential repository, and to realize sensitivity studies to the position and to the conductivity field.

8927 **(DOE/NE/44350—T1) Project profile of crystl. Land resources information service.** (North Carolina Dept. of Natural Resources and Community Development, Raleigh (USA). Div. of Land Resources). Apr 1986. Contract FG02-83NE44350. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87001704.

The US Department of Energy (DOE) plans to locate one high-level nuclear waste repository in the eastern United States by the year 2000. Current plans call for this repository to be located in crystalline rock formations. North Carolina is one of seventeen states with crystalline rock bodies that are under study. DOE is evaluating the geological aspects of the rock bodies as well as the impact a repository will have on the natural and cultural resources of the area. Funds have been granted to North Carolina from DOE to allow the state to review DOE's findings. A portion of these funds have been used to build digital geographic datasets that are being used for this evaluation and review. This report summarizes the data collected and methods used in entering them into the computer.

8928 **(DOE/RL—86-10) Perspective on methods to calculate a fee for disposal of defense high-level waste in combined (civilian/defense) repositories.** (USDOE Richland Operations Office, WA). Dec 1986. Contract AC06-76RL01830. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003615.

The Department of Energy intends to send the high-level waste from defense operations to combined civilian/defense repositories for disposal. The federal government must pay a fee to cover its fair share of the cost for the disposal system. This report provides an overview perspective on the defense high-level waste (DHLW) quantities and characteristics and on potential alternatives for calculation and payment of the disposal fee. Information on the DHLW expected from government sites includes the number of waste canisters, radioactivity, thermal decay power, mass of defense reactor fuel, and total electrical energy-equivalents. Ranges in quantities are shown where different operating scenarios are being considered. Several different fee determination methods are described and fees for different quantities of waste are estimated. Information is also included on possible payment alternatives, production and shipping schedules, and credits which could be applied to the fee.

8929 (DOE/WIPP—86-012) **Interim geotechnical data report.** (Bechtel National, Inc., San Francisco, CA (USA)). Fal 1986. Contract AC04-78AL10751. 732p. NTIS MF A01; 2; GPO Dep. File Number DE87003701.

This issue, the Interim Geotechnical Field Data Report, presents information obtained from the geotechnical activities at the WIPP site underground facilities since the last quarterly report. It also includes cumulative plots which contain all previous data. Finally, it continues the geotechnical analyses and interpretations of the data. The GFDR is organized into two principal parts. The first part, Geotechnical Field Data, presents in graphical form all the data collected since April 1982 from the geomechanical instruments. Presented in the second part, Evaluation and Analyses, are preliminary interpretations and analyses of the data. In this report, continuing geotechnical assessment of all the facility features is presented. Also included in the second part are separate sections on evaluation and interpretation of the instrumentation measurements, and an updated description and evaluation of observed behavior of the underground openings.

8930 (DP-MS—86-48) **Processing of transuranic waste at the Savannah River Plant.** Daugherty, B.A.; Gruber, L.M.; Mentrup, S.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1986. Contract AC09-76SR00001. 12p. (CONF-860905—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002639.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

Transuranic wastes at the Savannah River Plant (SRP) have been retrievably stored on concrete pads since early 1972. This waste is stored primarily in 55-gallon drums and large carbon steel boxes. Higher activity drums are placed in concrete culverts. In support of a National Program to consolidate and permanently dispose of this waste, a major project is planned at SRP to retrieve and process this waste. This project, the TRU Waste Facility (TWF), will provide equipment and processes to retrieve TRU waste from 20-year retrievable storage and prepare it for permanent disposal at the Waste Isolation Pilot Plant (WIPP) geological repository in New Mexico. This project is an integral part of the SRP Long Range TRU Waste Management Program to reduce the amount of TRU waste stored at SRP. The TWF is designed to process 15,000 cubic feet of retrieved waste and 6200 cubic feet of newly generated waste each year of operation. This facility is designed to minimize direct personnel contact with the waste using state-of-the-art remotely operated equipment.

8931 (DPST—83-652) **Elimination of the washable deep bed filter concept.** Wright, G.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 5 Jul 1983. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003112.

The Washable Deep Bed Filter (WDBF) was the basis for the reference DWPD melter off-gas system prior to the successful demonstration of the Hydro-sonic Scrubber. Experimental data obtained from the SFM and SCM-2 off-gas systems in addition to a theoretical analysis of the WDBF were the basis for elimination of this concept. Results of this study demonstrated that: Superficial Gas Velocity was 5 to 10 times greater than the velocity required to obtain satisfactory DF performance, increasing the WDBF pad area to correct gas throughput dependence was not possible due to canyon space restrictions, and staging of filters proved ineffective for improving DF performance. This report documents evolution of the present off-gas system design and the basis for elimination of the WDBF.

8932 (FMPC—2040) **Feed Materials Production Center waste management plan (Revision to NLCO-1100, R.6).** Watts, R.E.; Allen, T.; Castle, S.A.; Hopper, J.P.; Oelrich, R.L. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 15 Oct 1986. Contract AC05-86OR21600. 169p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87003062.

In the process of producing uranium metal products used in Department of Energy (DOE) defense programs at other DOE facilities, various types of wastes are generated at the Feed Materials Production Center (FMPC). Process wastes, both generated and stored, are discussed in the Waste Management Plan and include low-level radioactive waste (LLW), mixed hazardous/radioactive waste, and sanitary/industrial waste. Scrap metal waste and wastes requiring special remediation are also addressed in the Plan. The Waste Management Plan identifies the comprehensive programs developed to address safe storage and disposition of all wastes from past, present, and future operations at the FMPC. Waste streams discussed in this Plan are representative of the wastes generated and waste types that concern worker and public health and safety. Budgets and schedules for implementation of waste disposition are also addressed. The waste streams receiving the largest amount of funding include LLW approved for shipment by DOE/ORO to the Nevada Test Site (NTS) (MgF_2, slag leach filter cake, and neutralized raffinate); remedial action wastes (waste pits, K-65 silo waste); thorium; scrap metal (contaminated and noncontaminated ferrous and copper scrap); construction rubble and soil generated from decontamination and decommissioning of outdated facilities; and low-level wastes that will be handled through the Low-Level Waste Processing and Shipping System (LLWPSS). Waste Management milestones are also provided. The Waste Management Plan is divided into eight major sections: Introduction; Site Waste and Waste Generating Process; Strategy; Projects and Operations; Waste Stream Budgets; Milestones; Quality Assurance for Waste Management; and Environmental Monitoring Program.

8933 (INIS-mf—10514, pp vp) **Environmental isotopes assist in the site assessment of Vaalputs Radioactive Waste disposal facility.** Verhagen, B.T.; Levin, M. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8934 (INIS-mf—10514, pp vp) **Geology of the Vaalputs radioactive waste disposal site in the Republic of South Africa.** Andreoli, M.A.G.; Anderson, N.J.B.; Levin, M.; Niemand, N. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8935 (INIS-mf—10514, pp vp) **Resistivity studies on the Vaalputs radioactive waste disposal facility.** De Beer, J.H.; Blume, J. (Council for Scientific and Industrial Research, Pretoria, South Africa. National Physical Research Lab.). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8936 (INIS-mf—10514, pp vp) **Engineering seismic design criteria.** Wium, D.J.W.; Opperman, G.H.P. (Van Wyk and Louw Inc., Pretoria, South Africa). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8937 (INIS-mf—10514, pp vp) **Geohydrology of the Vaalputs radioactive waste disposal facility.** Levin, M.; Hambleton-Jones, B.B.; Raubenheimer, E.; Niemand, N. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8938 (INIS-mf—10514, pp vp) **Site selection issues for radioactive waste disposal in arid regions of the United States.** Gaynor, R.K. (US Ecology Consultants, Newport Beach, California, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8939 (INIS-mf—10514, pp vp) **Selection criteria for a radioactive waste disposal site in the Republic of South Africa.** Toens, P.D.; Hambleton-Jones, B.B. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8940 (INIS-mf—10514, pp vp) **Speciation aspects of predictive modelling in radioactive waste disposal.** Williams, D.R. (University of Wales Inst. of Science and Technology, Cardiff, UK). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8941 (INIS-mf—10514, pp vp) **Health physics programs in low-level radioactive waste management at the Institute of Nuclear Energy Research, Republic of China.** Chen, W.-L. (Institute of Nuclear Energy Research, Lung-Tan, Taiwan). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8942 (INIS-mf—10514, pp vp) **Treatment of wet solid low-level radioactive waste.** Chou, T.-S. Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8943 (INIS-mf—10514, pp vp) **Evaluation of the production of solid radioactive waste in the Tricastin nuclear power station and, more generally, in the other French nuclear power plants.** Cuisenier, R.G. (Electricite De France, BP 9, 26130 Saint Paul-3-Chateaux, France). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8944 (INIS-mf—10514, pp vp) **Characterization of products arising from the incorporation of low- and medium-level waste in cement or polymer matrix.** De Angelis, G.; Caropreso, G. (ENEA, Dept. of Environmental Protection and Man Health, CRE, Casaccia, Rome, Italy). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8945 (INIS-mf—10514, pp vp) **Incineration of burnable low-level waste.** Graebener, K.H.; Kirchenmayer, A.; Wasinger, K.L.V. (Kraftwerk Union A.G., Offenbach am Main, Germany, F.R.). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8946 (INIS-mf—10514, pp vp) **Treatment of solid radioactive waste by Electricite de France (EdF).** Jeanson, P. (Electricite de France, 93 - Saint-Denis). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8947 (INIS-mf—10514, pp vp) **Operational experiences in the treatment of low- and medium-level radwaste in the Federal Republic of Germany (FRG).** Lindow, W.; Herbrechter, D.; Stegmaier, W. (Kraftanlagen A.G., Heidelberg, Germany, F.R.). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8948 (INIS-mf—10514, pp vp) **Metamict materials as model substances for radwaste.** Mueller, H. (Institute of Inorganic and Analytic Chemistry, Section Radio-Chemistry, Freiburg, i.Br., Federal Republic of Germany). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8949 (INIS-mf—10514, pp vp) **Radioactive waste management at Rocky Flats.** Navratil, J.D. (Colorado School of Mines, Golden, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8950 **(INIS-mf—10514) Radwaste '86: Abstracts volume. Conference on the treatment and containment of radioactive waste, and its disposal in arid regions.** Ainslie, L.C. (ed.). (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Aug 1986. 89p. (CONF-860909—Absts.). NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294.

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

The conference dealt with the treatment and containment of radioactive wastes and its disposal in arid environments. Papers were delivered on the various aspects of site selection. Waste transportation, and the storage and disposal of wastes at the Vaalputs radioactive waste disposal facility in the Republic of South Africa and in other parts of the world are discussed.

8951 (INIS-mf—10514, pp vp) **Feasibility of disused underground mines for low-level and intermediate-level radioactive waste disposal.** Brewitz, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig, Germany, F.R. Inst. fuer Tieflagerung). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8952 (INIS-mf—10514, pp vp) **Resin drying in high integrity containers-advanced waste stabilization methodology.** Carson, M.P. (Nupac Services, Columbia, South Carolina, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8953 (INIS-mf—10514, pp vp) **Development of a metallic high integrity container.** Haelsig, R.T. Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8954 (INIS-mf—10514, pp vp) **Design criteria for experimental radioactive waste disposal trenches at the Vaalputs radioactive waste disposal facility.** Hambleton-Jones, B.B.; Moore, P.E. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8955 (INIS-mf—10514, pp vp) **Operating considerations of shallow land disposal.** Jones, D.F. (Pacific Nuclear Systems, Inc., Washington, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8956 (INIS-mf—10514, pp vp) **Swedish studies of high-level waste disposal in crystalline rock.** Krauskopf, K.B. (Stanford Univ., CA, USA. Dept. of Geology). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8957 (INIS-mf—10514, pp vp) **Design and performance of a low-cost, soil cement cap for LLNW disposal trenches.** Nowatzki, E.A. (Arizona Univ., Tucson, USA. Dept. of Civil Engineering and Engineering Mechanics). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8958 (INIS-mf—10514, pp vp) **Dry storage of spent fuel: current practice, experience and development trends.** Ospina-Esperon, C.J. (Swiss Federal Institute for Reactor Research, Wurenlingern, Switzerland). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8959 (INIS-mf—10514, pp vp) **Cask-system for conditioning, transport and storage of radioactive waste.** Rittscher, D.; Gesterman, G.; Kroth, K.; Lammertz, H. (Gesellschaft fuer Nuklearservice, Essen, Germany, F.R.; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8960 (INIS-mf—10514, pp vp) **Earth science considerations on the storage and disposal of radioactive waste and spent nuclear fuel in Taiwan, Republic of China.** Soong, K.L. (Institute of Nuclear Energy Research, Atomic Energy Council, Taiwan, Republic of China). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8961 (INIS-mf—10514, pp vp) **Radioactive waste disposal: solutions persued in South Africa by ESCOM.** Spencer, P.H.; Roehm, H.F.; Harris, M.I.J. (Electricity Supply Commission, Johannesburg, South Africa). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8962 (INIS-mf—10514, pp vp) **Geotechnical aspects of trench capping for the Vaalputs radioactive waste disposal facility.** Stephenson, D.; Moore, P.E.; Hambleton-Jones, B.B. (University of the Witwatersrand, Johannesburg, South Africa; Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8963 (INIS-mf—10514, pp vp) **Improvement program of Lan-Yu radwaste receiving and storage facility in Taiwan, ROC.** Tsai, C.M.; Lee, R.T. (Radwaste Administration, Atomic Energy Council, Taiwan, Republic of China). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8964 (INIS-mf—10514, pp vp) **Radioactive waste disposal in South Africa.** Van der Westhuizen, H.J.; Moore, P.E. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8965 (INIS-mf—10514, pp vp) **Safety and licensing requirements in the Republic of South Africa.** Simpson, D.M.; Langford, E.L. Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8966 (KURRI-TR—268, pp 1-4) **Technical approach to some problems concerning the radioactive liquid waste treatment 1. The outline of treatment systems and the behavior of radioactive nuclides in liquid waste.** Kitagawa, Isao; Ohno, Kazutami; Kan, Isao. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.). 1985. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780040. (CONF-8408209—).

From Development of advanced technology for scientific research conference; Kumatori, Osaka, Japan (7 Aug 1984).

This report describes the outline of the radioactive liquid waste treatment systems and the procedure for the measurements of radioactive nuclide concentration in liquid waste in Research Reactor Institute, Kyoto Univ. Since 1979, γ-ray spectrometries have been made using Ge semiconductor detector and revealed the behavior of radioactive nuclides in liquid waste during treatments. Several illustrations are presented and the results obtained are summarized as follows: (1) Coagulation and precipitation treatment is effective to remove total α-radioactivity and ^{60}Co. (2) Inorganic ion-exchange treatment is necessary to remove ^{137}Cs validly. (3) Organic ion-exchange treatment is necessary to remove ^{51}Cr validly.

8967 (MLM—3407(OP)) **Tools for decontamination and decommissioning of nuclear facilities.** Hermetz, R.E. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1986. Contract AC04-76DP00053. 3p. (CONF-861102—28). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003021.

From American Nuclear Society and Atomic Industrial Forum joint meeting; Washington, DC, USA (16 Nov 1986).

The Decontamination & Decommission (D & D) of nuclear facilities requires many different tools. These can vary from small hand tools to the heavy equipment used to remove concrete and soil. Tools for D & D should be reliable, versatile, economical, and easily disposed of in case they become contaminated. In our search to find tools to do the work proficiently, many tools were considered. The ongoing effort to improve old procedures and develop new ones, as new and unusual equipment was needed, allowed us to get the job done in a timely and cost-effective manner.

8968 (NAGRA-NGB—85-03) **Project guarantee 1985: Final storage for high level waste: Construction and operation.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1985. 226p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87900174.

The main aim of the 1985 Project Gewaehr ("Guarantee") is to demonstrate the long-term safety of a final repository for radioactive waste. However, this aspect of long-term safety is closely related to that of technical feasibility so that all construction options being considered as a basis for safety analysis of the repository must also be capable of realization on a technical and organizational basis. An engineering project study aimed at demonstrating the feasibility of constructing a deep repository for high-level waste (Type C repository) has been carried out; the study is based on a model data-set representing typical geological and rock mechanical conditions as found outside the so-called Permocarboniferous basin the regions under investigation by Nagra in Cantons Aargau, Schaffhausen, Solothurn and Zurich. The project described in the present report permits the conclusion that construction of a repository for high-level radioactive waste and, if necessary, spent fuel-rods is feasible with present-day technology. This takes into consideration quantitative and operational constraints as well as relevant (in constructional engineering terms) geological and hydrogeological data of the model data-set which is based upon field observations. The construction concept is flexible enough to be adapted to take into consideration the various conditions which can be expected in the host rock.

8969 (NAGRA-NGB—85-04) **Project guarantee 1985: Final storage for high level waste: The Safety Barrier System.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1985. 343p. (In German). NTIS (US Sales Only), PC A15/MF A01. File Number DE87900175.

Final disposal of radioactive waste involves preventing the waste from returning from the repository location into the biosphere by means of successively arranged containment measures known as safety barriers. In the present volume NGB 85-04 of the series of reports for Project "Gewaehr" 1985, the safety barrier system for the type C repository for high-level waste is described. The barrier parameters which are relevant for safety analysis are quantified and associated error limits and data scatter are given. The aim of the report is to give a summary documentation of the safety analysis input data and their scientific background.

8970 (NAGRA-NGB—85-05) **Project guarantee 1985: Final storage for high level waste: Safety report.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1985. 258p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87900176.

Disposal of radioactive waste involves preventing releases to the biosphere for a long period of time and subsequently limiting the magnitude of releases by means of a series of safety barriers. These safety barriers consist of both technically constructed containment and of suitable geological formations at the repository site. The technical safety barrier system in the case of high-level waste comprises: the waste solidification matrix (borosilicate glass); massive steel canisters; encasement of the waste canisters in highly compacted bentonite; and sealing of void spaces and access routes on repository closure. The geological barriers are formed by the crystalline bed-rock and the overlying sedimentary layers. In order to perform a safety assessment the behavior of these technical barriers and of the host rock must be understood and this understanding must be translated into quantitative models which allow calculation of repository performance. In volume NGB 84-04 of the reports of Project Gewaehr 1985, the characterization of individual barriers and approaches to modelling their performance are described. These models and data are used in the safety analysis, the results of which are summarized in this report. The safety studies in the present report show that models are available which allow the behavior of a repository over long time periods to be analyzed. By evaluating earlier studies and experimental investigations, and by carrying out further measurements in the laboratory and in the field, sufficient data has been collected to allow proper use of these models in a safety analysis. The resulting calculations show that, for a base case with realistic/conservative parameter values, predicted radiation doses are negligibly small. Even when using very conservative data and when accumulating conservative assumptions in the analysis, the doses remain clearly below the radiological protection target of 10 mrem/year.

8971 (NAGRA-NGB—85-06) **Project Guarantee 1985: Final storage for low- and intermediate-level waste: Construction and operation.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1985. 183p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87900173.

The main objective of the 1985 Project "Guarantee" is to demonstrate the long-term safety of a final repository for radioactive waste. However, the aspect of long-term safety is closely associated with that of technical feasibility, so that all construction options being considered as a basis for the safety analysis of the repository must also be capable of realization on a technical and organizational basis. A constructional engineering project study aimed at clarification of the feasibility of a repository for low- and intermediate-level radioactive waste (type B repository) has been carried out; the study is based on a model data-set derived from the geological, rock mechanical and topographical characteristics of one of Nagra's planned exploration areas. The project described in the present report justifies the conclusion that construction of a repository for low- and intermediate-level radioactive waste is feasible with present-day technology. This conclusion takes into consideration quantitative and operational constraints as well as geological and hydrogeological data relevant to constructional engineering. The latter are derived from a model data-set based on a specific locality.

8972 **(NAGRA-NGB—85-07) Project Guarantee 1985: Final disposal for low- and intermediate-level waste: The safety barrier system.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1985. 253p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87900255.

Final disposal of radioactive waste involves preventing the waste from returning from the repository location into the biosphere by means of successively arranged containment measures known as safety barriers. In the present volume NGB 85-07 of the series of reports for Project "Gewaehr" 1985 the safety barrier system for the type B repository for low- and intermediate-level waste is described. The barrier parameters which are relevant for safety analysis are quantified and associated error limits and data scatter are given. The aim of the report is to give a summary documentation of the safety analysis input data and their scientific background.

8973 **(NAGRA-NTB—84-23) Concept and plans for a station for the encapsulation of vitrified highly radioactive waste into containers for final disposal.** (STEAG Kernenergie G.m.b.H., Essen (Germany, F.R.)). Sep 1984. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87900265.

The report presents a concept and plans for a station for the encapsulation of vitrified highly radioactive waste into containers for final disposal. The process steps, the layout of the station, the main components of equipment and the sequence of operations under normal conditions are described. The station is designed for vitrified waste from reprocessing. The volume of the waste packages is 150 1, and each package contains the equivalent of 1.33 ton HM of fuel. The radionuclide activity of the waste corresponds to spent fuel with a decay time of 40 years from discharge from the reactor. It is assumed that after transport under normal conditions the steel shell enclosing the waste is gastight and its surface is free of contamination. The containers for final disposal are made of cast steel and have the form of hollow cylinders with hemispherical ends; their overall length is 2 m and their overall diameter 0.94 m. The station is so designed that the whole procedure, from supply of the transport containers containing the waste to the delivery of the full final disposal containers, is carried out by remote control behind radiation screens in an area isolated from the environment. Containers that do not fulfill the quality control requirements can be improved or repaired in a special rework cell without interfering with the further normal operation of the plant.

8974 **(NAGRA-NTB—84-34) The Betznau nuclear borehole.** (National Science Foundation, Washington, DC (USA)). Oct 1984. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87900262.

On the occasion of a review of safety aspects related to possible earthquake occurrences in the area of the two nuclear power reactors at Betznau, several shallow boreholes were drilled on behalf of Nordostschweizerische Kraftwerke AG on Beznau island in the river Aare during winter 1979/80. One of the borings (coord. 659491/267242) located ~75 m NNE of reactor building II was cored over its total length and taken to a greater depth of 321.8 m. Because this well offered a good opportunity to gather important results for the research program of Nagra in northern Switzerland, it was investigated in a very comprehensive way with sedimentological, mineralogical and geochemical methods and with geophysical, rock-mechanical, hydrogeological and radio isotope techniques. This is the first deeper borehole drilled in Switzerland that has been evaluated to such a great extent. The results of the investigation are presented.

8975 **(NAGRA-NTB—84-38) Leuggern borehole probing work program.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jul 1984. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87900276.

Nagra, the National Cooperative for the Storage of Radioactive Waste is carrying out a comprehensive geological research program in northern Switzerland. This will provide the scientific knowledge which is required for assessment of the feasibility of safe disposal of highly radioactive waste in the geological formations of the area. The various investigations comprise a program of 12 deep boreholes, a regional geophysical reconnaissance of the petrographical and structural conditions, a hydogeological program for the clarification of groundwater movements in the deep subsurface and neotectonic observations to detect and measure active crustal movements. On June 24, 1980 Nagra submitted to the Swiss federal authorities a request for permission to drill 12 deep boreholes for scientific purposes. This drilling campaign aims at the geological evaluation of the crystalline basement and its sedimentary cover in an area of approx. 1200 km^2. In addition, the wells should supply much needed hydrodynamical and geochemical data for the construction of a mathematical model simulating the hydrogeological conditions in the earth's crust between the northern slope of the central and eastern Swiss Alps and the black Forest. The federal permits for 11 of the 12 boreholes were granted on February 17, 1982 and drilling began at Boettstein in October 1982. At this location, an extensive testing program has been completed and the well is now in the observation phase. The second well in the sequence, Weiach, was spudded in January 1983 and is about to enter the observation phase. The third well, Riniken, started in June 1983 and was suspended for the time being at a depth of 1800.5 m. The fourth well, Schafisheim (spudding date November 26, 1983), and the fifth well, Kaisten (spudding date February 13, 1984), have reached total depth at 2006 m and 1306 respectively.

8976 **(PNL-SA—13738) Electrochemical process for dissolving plutonium dioxide and leaching plutonium from scrap or wastes.** Bray, L.A.; Ryan, J.L.; Wheelwright, E.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 21p. (CONF-861146—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003172.

From AIChE winter annual meeting; Miami, FL, USA (2 Nov 1986).

Dissolution of plutonium (PU) from high-fired plutonium dioxide (PuO_2) and the leaching of Pu from scrap or wastes have often posed difficult process problems. Traditionally, dissolution has been accomplished using 12 M HNO_3-0.18 M HF at boiling temperatures. This work discusses the development of electrochemical dissolution of PuO_2 in compartmented cells. Small amounts of oxidation catalysts are used to carry electrons from the solid PuO_2 to the anode surface, producing PuO_2^{2+} solution. PuO_2 that has been fired at temperatures to 1700°C can be dissolved at 25°C to concentrations exceeding 400 g Pu/L using the catalyzed electrochemical plutonium oxide dissolution (CEPOD) process. The silver ion is used as the redox catalyst. The dissolution rates are 5 to 15 times faster than the rates obtained using the current process (12 M HNO_3-0.18 M HF), and the corrosive fluoride ion is avoided.

8977 **(PNL-SA—13954) LFCM [liquid-fed eramic melter] emission and off-gas system performance for feed component cesium.** Goles, R.W.; Andersen, C.M. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1986. Contract AC06-76RL01830. 18p. (CONF-860905—25). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003406.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

Except for volatile off-gas effluents, overall adequacy of the liquid-fed ceramic melter (LFCM) system depends most upon its effectiveness in dealing with cesium. However, the mechanism responsible for melter cesium losses has proved insensitive to many LFCM operating and processing conditions. As a result, variations in inleakage, plenum temperature, feeding rate and waste loading do not significantly influence melter cesium performance. Feed composition, specifically halogen content, is the only processing variable that has had a significant effect. Due to the submicron nature of LFCM-generated aerosols, melter disengagement design features are not expected to be particularly effective in reducing cesium emission rates. For the same reason, the cesium performance of conventional quench scrubbers is quite low, being dependent only upon the magnitude of melter entrainment losses. Although a deep bed washable filter has been effective in removing submicron aerosols from the process exhaust, high performance has only been achieved under dry operating conditions. The melter's idling state does not appear to place additional demands upon the off-gas treatment system.

8978 **(PNL-SA—14056) Development and evaluation of a tracer-injection hydrothermal technique for studies of waste package interactions.** Jones, T.E.; Coles, D.G.; Britton, R.C.; Burnell, J.R. (Pacific Northwest Lab., Richland, WA (USA); Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Nov 1986. Contract AC06-76RL01830. 13p. (CONF-861207—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003093.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A tracer-injection system has been developed for use in characterizing reactions of waste package materials under hydrothermal conditions. High-pressure liquid chromatographic instrumentation has been coupled with Dickson-type rocking autoclaves to allow injection of selected components into the hydrothermal fluid while maintaining run temperature and pressure. Hydrothermal experiments conducted using this system included the interactions of depleted uranium oxide and Zircaloy-4 metal alloy discs with trace levels of ^{99}Tc and non-radioactive Cs and I in a simulated groundwater matrix. After waste-package components and simulated waste forms were pre-conditioned in the autoclave systems (usually 4 to 6 weeks), known quantities of tracer-doped fluids were injected into the autoclaves' gold reaction bag at run conditions. Time-sequenced sampling of the hydrothermal fluid providing kinetic data on the reactions of tracers with waste package materials. The injection system facilitates the design of experiments that will better define "steady-state" fluid compositions in hydrothermal reactions. The injection system will also allow for the formation of tracer-bearing solid phases in detectable quantities.

8979 **(PNL-SA—14065) In situ vitrification: A candidate process for in situ destruction of hazardous waste.** FitzPatrick, V.F.; Timmerman, C.L.; Buelt, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 22p. (CONF-861227—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003099.

From Superfund '86; Washington, DC, USA (1 Dec 1986).

This report describes the large-scale in-situ vitrification (ISV) system, discusses its capabilities, and summarizes the results of testing to date. PNL recognizes that ISV is not the solution to all hazardous waste management problems. But judiciously applied, ISV can offer technical and economic improvements to state-of-the-art remedial action technology. With understanding of the process design and functions, the waste manager can make sound judgements about the applicability of ISV to site-specific disposal problems.

8980 **(PNL-SA—14291) Recent international developments in low-level waste disposal.** Mitchell, S.J.; Lakey, L.T.; Harmon, K.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 12p. (CONF-860990—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003094.

From 8. annual participants' information meeting of the DOE Low-Level Waste Management Program; Denver, CO, USA (22 Sep 1986).

Recent international developments in low-level waste (LLW) disposal have included a move away from ocean dumping and a trend towards engineered and deeper dispoosal. Siting efforts have accelerated as interim storage facilities and existing sites reach capacity. The suspension of ocean dumping by the London Dumping Conventions of 1983 and 1985 has affected the LLW disposal practices of several countries, including the United Kingdom, Belgium, the Netherlands, Switzerland, and Japan. Their plans now include disposal in trenches, shallow concrete pits, deep mines, subseabed caverns, horizontal mountain tunnels, and long-term storage facilities. Other recent developments include selection of the semidesert Vaalputs site in South Africa, licensing activities for the Konrad mine site in the Federal Republic of Germany, design of at-reactor sites in Finland, and construction of a Baltic Sea site in Sweden. Also, the French have recently selected the Aube site for engineered disposal in monoliths and tumuli, now used at the La Manche site.

8981 **(PNL-SA—14342) Remote canister level/turntable positioning system.** Goles, R.W.; Hof, P.J.; Dierks, R.D.; Holton, L.K. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 26p. (CONF-861102—29). NTIS, PC A03/MF A01; GPO Dep. File Number DE87003304.

From American Nuclear Society and Atomic Industrial Forum joint meeting; Washington, DC, USA (16 Nov 1986).

A remote, contactless, microprocessor control system has been designed to accurately position glass-receiving canisters beneath PNL's radioactive liquid-fed ceramic melter and to monitor the elevation and extent of canister cross-sectional glass fill. Both tasks are accomplished using in-cell γ-ray sources and out-of-cell detection, analysis, and data interpretative equipment. The system establishes axial canister/melter overflow section alignment to an uncertainty of about 3 mm. Canister glass level at 11 fixed elevations is measured to a +-5 mm uncertainty, while as little as 5 mm of linear cross-sectional voiding (or equivalent glass thickness) can be detected in 30-cm-diameter canisters.

8982 **(PNL-SA—14463) Equipment experience in a radioactive LFCM [liquid-fed ceramic melter] vitrification facility.** Holton, L.K. Jr.; Dierks, R.D.; Sevigny, G.J.; Goles, R.W.; Surma, J.E.; Thomas, N.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 25p. (CONF-861102—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003302.

From American Nuclear Society and Atomic Industrial Forum joint meeting; Washington, DC, USA (16 Nov 1986).

Since October 1984, the Pacific Northwest Laboratory (PNL) has operated a pilot-scale radioactive liquid-fed ceramic melter (RLFCM) vitrification process in shielded manipulator hot cells. This vitrification facility is being operated for the Department of Energy (DOE) to remotely test vitrification equipment components in a radioactive environment and to develop design and operation data that can be applied to production-scale projects. This paper summarizes equipment and process experience obtained from the operations of equipment systems for waste feeding, waste vitrification, canister filling, canister handling, and vitrification off-gas treatment.

8983 **(RHO-BW-SA—462P) Gamma and alpha radiation levels in a Basalt High-Level Waste Repository: Potential impact on container corrosion and packing properties.** Reed, D.T.; Bonar, S.D.; Weiner, M.F. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1985. Contract AC06-77RL01030. 26p. (CONF-850981—9). NTIS, PC A03/MF A01; GPO Dep. File Number DE87003150.

From International symposium on coupled processes affecting the performance of a nuclear waste repository; Berkeley, CA, USA (18 Sep 1985).

Gamma radiation levels during the containment period and alpha radiation levels in the packing material during the controlled release period were calculated based on the conceptual design of the waste package for a high-level nuclear waste repository in basalt. The maximum gamma dose rate was 250 rad/h and the maximum absorbed dose during the containment period was 66 Mrad. The alpha radiation levels calculated were strongly dependent on the assumed solubility and sorption of the radionuclides considered. The total absorbed alpha dose was 1.4×10^{10} rad at the packing/container interface, and 1.2×10^{10} and 1.1×10^{10} rad at 7 and 19 cm from the container wall, respectively. The radiation levels calculated were discussed in relation to two issues: the radiolytic enhancement of container corrosion during the containment period and the effect of alpha radiation on the stability of packing material during the controlled release period.

8984 **(RHO-HS-SR—85-1P) Rockwell Hanford Operations effluents and solid waste burials during calendar year 1985.** Boothe, G.F.; Aldrich, R.C.; Shay, R.S.; Stanfield, L.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jul 1986. Contract AC06-77RL01030. 162p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87002947.

Rockwell Hanford Operations (Rockwell) operates facilities at the Hanford Site under contract to the US Department of Energy (DOE). The facilities generate radioactive and nonradioactive solid, liquid, and airborne wastes that must be disposed of, stored, or discharged to the environment. No radioactive liquid or solid wastes are discharged or disposed of offsite. The quantities of solid, liquid, or gaseous wastes buried or discharged during calendar year (CY) 1985 are reported in this document in compliance with DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements." In CY 1985, all liquid and airborne discharges of radioactive materials were in compliance with DOE requirements. The Plutonium-Uranium Extraction (PUREX) Facility ammonia scrubber discharge stack (296-A-24) exceeded the Rockwell administrative control value for ^{106}Ru by a factor of 1.17. All other radioactive airborne discharges were below control values. Two liquid streams exceeded Rockwell administrative control values. The PUREX process condensate stream exceeded the /sup 239,240/Pu control value by a factor of 2.7 and the ^{241}Pu control value by a factor of 1.6. The PUREX ammonia scrubber stream exceeded the /sup 89,90/Sr control value by a factor of 3.2. All other liquid streams were below control values. The 200 Area power plants operated in compliance with the requirements of the Benton-Franklin-Walla Walla County Air Pollution Control Authority. There were no opacity violations; all deviations from opacity guidelines were promptly reported. Six deviations were reported in CY 1985. Oxides of nitrogen (NO/sub x/) emissions from PUREX and the UO_3 Plant were below annual limits for CY 1985.

8985 **(SAND—85-7114) Hydrologic mechanisms governing partially saturated fluid flow in fractured welded units and porous non-welded units at Yucca Mountain.** Wang, J.S.Y.; Narasimhan, T.N. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC04-76DP00789. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003587.

A discrete fracture, porous matrix model and a composite medium model were used to study hydrological responses to cycles of pulse infiltration at Yucca Mountain, a potential site for a nuclear waste repository. The pulses were applied to fractures at the top of a vertical column composed of alternating layers of welded and nonwelded volcanic tuff. For average infiltration rates of 0.1 to 0.5 mm/yr, pulses expressed as short durations separated by periods up to 5000 yr, the transition from partially saturated conditions to fully saturated conditions and the corresponding onset of fracture flows occur in the top Tiva Canyon welded unit. As water moves down into the Paintbrush nonwelded unit, most effects of the transient infiltration pulse are damped during the first few thousand years. The responses of the underlying Topopah Spring welded unit to the pulses exhibit only small changes in saturation, pressure, and potential from the steady-state values. In addition to the downward motion, some of the infiltrating water may move laterally. Lateral flows in the column model are caused by an assumed fixed gradient in the horizontal direction, corresponding to the eastward dip of the bedding planes. For 0.1 mm/yr average infiltration cases which the fixed-gradient approximation is applicable under steady-state conditions, the infiltration pulses prefer to move essentially downward with a small fraction of water moving laterally.

8986 **(SAND—86-2192C) Radiometric dating of Ochoan (Permian) evaporites, WIPP [Waste Isolation Pilot Plant] site, Delaware Basin, New Mexico, USA.** Brookins, D.G.; Lambert, S.J. (New Mexico Univ., Albuquerque (USA). Dept. of Geology; Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 11p. (CONF-861207—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002484.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

We have attempted radiometric dating of halide-sulfate salts and clay minerals from the Delaware Basin, New Mexico, USA, as part of geochemical study of the stability of the evaporite sequence at the WIPP (Waste Isolation Pilot Plant - a US DOE facilty) site. We undertook this dating to determine: (1) primary age of evaporite genesis or time(s) of recrystallization; (2) if previously undated evaporite minerals (leonite, polyhalite, kieserite) give useful data; and (3) if the detrital clay minerals have been radiometrically reset at any time following their incorporation into the evaporite medium. We have shown earlier that polyhalites can indeed be successfully dated by the K-Ar method, and once corrections are applied for admixed halide minerals, dates of 210-230 Ma for the Delaware Basin are obtained. Rb-Sr isochrons from early stage sylvites-polyhalites- anhydrites yield 220 +- 10 Ma, even when some sylvites yield lower K-Ar dates due to loss of *40-Ar. K-Ar dates on leonites and kieserities are also low due to *40-Ar loss, but their Rb-Sr dates are higher. Detrital clay minerals from the Delaware Basin collectively yield a highly scattered isochron (390 +- 77 Ma), but samples from a local area, such as the WIPP Site, give a much better age of 428 +- 7 Ma. These dates show that the interaction between the clay minerals and the evaporitic brines was insufficient to reset the clay minerals Rb-Sr systematics. In a related study, we note that a dike emplaced into the evaporite at 34 Ma had only very limited effect on the intruded rocks; contact phenomena were all within 2 m of the dike. All of our geochemical (radio-metric and trace element) studies of the WIPP site argue for preservation of the isotopic and chemical integrity of the major minerals for the past 200 Ma.

8987 **(YJT—86-12) Stress analysis of Olkiluoto reactor waste repository.** Halonen, O. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Jun 1986. 64p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750407.

The Olkiluoto reactor waste repository was analysed by using four different plane and axisymmetric analyses in order to determine the secondary state of stress in the vicinity of the reactor waste silos. The stress calculations were performed by using linear elastic material model. The calculated principal stresses were used to estimate failure in rock mass according to Hoek and Brown's empirical failure criterion, which takes into account the quality of rock mass. The rock mass quality in the vicinity of the reactor waste silos was 'very good' according to NGI-classification. The Q-value is between 75 and 100. All the failure estimations were carried out by using two Q-values (40 and 100). The failure analyses showed no significant failure around the silos. Based on the results of the analyses the reactor waste silos are stable.

8988 **Permanent disposal of radioactive particulate waste in cartridge containing ferromagnetic material.** Troy, M. (to Westinghouse Electric Corp., Pittsburgh, PA). US Patent 4,623,510. 18 Nov 1986. Filed date 28 Oct 1983. v.p.

This patent describes a cartridge for permanent disposal of solid radioactive particulate waste, comprising; a liquid impervious casing having an upper end cover, a lower end cover and a side wall extending between the covers, the casing enclosing a waste storage region; ferromagnetic fibrous material defining a waste retaining matrix and filling a major portion of the waste storage region; means defining an inlet conduit extending through the upper end cover and axially of the casing through the waste storage region, and opening into the waste storage region in the vicinity of the lower and end cover; and means defining first and second outlet conduits extending through the upper end cover and opening into the waste storage region in the vicinity of the upper end cover.

8989 **Sensitivity analysis using computer calculus: A nuclear waste isolation application.** Oblow, E.M.; Pin, F.G.; Wright, R.Q. (Oak Ridge National Lab., Engineering Physics and Mathematics Div. Oak Ridge, TN 37831). *Nuclear Science and Engineering;* **94**: No. 1, 46-65(Sep 1986).

An automated procedure for performing large-scale sensitivity studies based on the use of computer calculus is presented. The procedure is embodied in a FORTRAN precompiler called GRESS, which automatically processes computer models adding derivative-taking capabilities to the normal calculated results. The theory and applicability of the GRESS codes are described and tested against a major geohydrological modeling problem. The

SWENT nuclear waste repository modeling code is used as the basis for these studies. Results for a test problem involving ground-water flow in the vicinity of the Richton Salt Dome are discussed in detail. Sensitivity results are compared with analytical, perturbation, and alternate sensitivity approaches to the problem. Five-place accuracy in these sensitivity results is verified for all cases in which the effects of nonlinearities are made sufficiently small. Conclusions are drawn as to the applicability of GRESS in the problem studied and for more general large-scale modeling sensitivity studies.

8990 (ORNL/tr—86/31) **System study of alternative waste management techniques: Final report.** (Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1986. Contract AC05-84OR21400. Translation of KWA 2190/1, December 1984. 411p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE87003176.

This report summarizes the important results achieved in conjunction with the Research and Development Priority "Alternative Waste Management Techniques" sponsored by the Federal Ministry of Research and Technology from 1981 to 1984. The subject of these studies was solely "direct disposal" of spent fuel elements. For this purpose a reference concept was selected from a variety of possible processes and engineered in detailed form by firms in the nuclear industry. Those who worked on the engineering concepts consider this waste management method technically feasible. Several disposal casks have been fabricated. The basic licensability of direct disposal can be evaluated on the basis of the documentation developed by the companies. The direct disposal method was compared with the "integrated waste management concept" using reference fuel cycles with respect to the following criteria: radiological safety and nuclear material safeguards and, in addition, economic and energy-policy aspects. It was found that with respect to radiological safety, including the long-term safety of the final repository, there are no significant differences between the two fuel cycles with and without reprocessing. With respect to the nuclear material safeguards of a final repository containing spent fuel elements, there are still a number of unanswered questions. From an economic standpoint, direct disposal will be more economical in the foreseeable future than integrated waste management. Quantification of the effects of one or the other waste management method on the national economy is not necessarily possible. Reprocessing is supported primarily by technological and energy-policy considerations. On the basis of the results, the conclusion is reached that reprocessing should be pursued further, but that at the same time direct disposal should be developed to the point of practical maturity.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 8907, 9002, 9184, 9187

8991 (BMI/ONWI—625) **GRASP [GRound-Water Adjunct Sensitivity Program]: A computer code to perform post-SWENT [simulator for water, energy, and nuclide transport] adjoint sensitivity analysis of steady-state ground-water flow: Technical report.** Wilson, J.L.; RamaRao, B.S.; McNeish, J.A. (Intera Technologies, Inc., Austin, TX (USA)). Nov 1986. Contract AC02-83CH10140. 328p. NTIS, PC E12/MF A01; 1; GPO Dep. File Number DE87003681.

GRASP (GRound-Water Adjunct Senstivity Program) computes measures of the behavior of a ground-water system and the system's performance for waste isolation, and estimates the sensitivities of these measures to system parameters. The computed measures are referred to as "performance measures" and include weighted squared deviations of computed and observed pressures or heads, local Darcy velocity components and magnitudes, boundary fluxes, and travel distance and time along travel paths. The sensitivities are computed by the adjoint method and are exact derivatives of the performance measures with respect to the parameters for the modeled system, taken about the assumed parameter values. GRASP presumes steady-state, saturated grondwater flow, and post-processes the results of a multidimensional (1-D, 2-D, 3-D) finite-difference flow code. This document describes the mathematical basis for the model, the algorithms and solution techniques used, and the computer code design. The implementation of GRASP is verified with simple one- and two-dimensional flow problems, for which analytical expressions of performance measures and sensitivities are derived. The linkage between GRASP and multidimensional finite-difference flow codes is described. This document also contains a detailed user's manual. The use of GRASP to evaluate nuclear waste disposal issues has been emphasized throughout the report. The performance measures and their sensitivities can be employed to assist in directing data collection programs, expedite model calibration, and objectively determine the sensitivity of projected system performance to parameters.

8992 (IAE—1978/E-1/E/B) **Investigation of radioactive contaminations of the environment in the surroundings of the Institute of Nuclear Research at Swierk in the years 1977-1980.** Pensko, J.; Stpiczynska, Z.; Hryczuk, O.; Kowalska, A. (Institute of Atomic Energy, Otwock-Swierk (Poland)). 1983. 33p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

The results of measurements of the contamination level of the environment in the surroundings of the Institute of Nuclear Research at Swierk and in surroundings of the repository of radioactive wastes at Rozan including the possible paths of migration of the radionuclides in the years 1977-1980 have been presented. The investigations proved that the radioactive fall-out from nuclear weapon tests was the main source of contamination. In the period of investigation the quantities of the radionuclides discharged into the sanitary sewage system did not exceed the weekly limit of 2590 MBq (70mCi). They had no influence on the level of the radioactive contaminations of the Vistula river water. Sporadically observed, the increased level of the radioactive contamination of the draining system water at Swierk exceeded at most 3 times the permissible concentration of ^{90}Sr for drinking water 2.6 Bq dm^{-3}. The radioactive contamination of the water, soil, grass and rye investigated around the Centre have been shown in the same level as for the reference points being out of the range of the influence of the Institute.

8993 (INIS-mf—10514, pp vp) **Botanical aspects of the ecological integrity of the Vaalputs radioactive waste disposal facility.** Hall, A.V. (Cape Town Univ., South Africa). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8994 (INIS-mf—10514, pp vp) **Zoological aspects of the ecological integrity of the Vaalputs radioactive waste disposal facility.** Nel, J.A.J.; Picker, M.D.; Robinson, T.J. (Stellenbosch Univ., South Africa. Dept. of Zoology; Cape Town Univ., South Africa. Dept. of Zoology; Mammal Research Institute, University of Pretoria, South Africa). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8995 (INIS-mf—10514, pp vp) **Vaalputs environmental monitoring programme.** Van As, D.; Posnik, S.; Bain, C.A.R. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8996 (INIS-mf—10514, pp vp) **Impact assessment of buried low-level wastes under unsaturated flow conditions.** Eichholz, G.G. (Georgia Inst. of Tech., Atlanta, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

8997 (NUREG/CR—2675-Vol.6) **Relevance of biotic pathways to the long-term regulation of nuclear waste disposal: Phase 2, Final report.** McKenzie, D.H.; Cadwell, L.L.; Kennedy, W.E. Jr.; Prohammer, L.A.; Simmons, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 94p. (PNL—4241-Vol.6). NTIS, PC A05/MF A01 - GPO. File Number TI87003043.

The results reported here establish the relevance and propose a method for including biotic transport in the assessment and licensing process for commercial low-level waste disposal sites. Earlier work identified the biotic transport mechanisms and process scenarios linking biotic transport with dose to man, and developed models for assessment of impacts. Model modification and improvement efforts in enhancing the ability to represent soil erosion and soil transport within the trench cover. Two alternative hypotheses on plant root uptake were incorporated into the model to represent transport of radionuclides by roots that penetrate the buried waste. Enhancements were also made to the scenario for future site intruder activities. Representation of waste package decomposition in the model was confirmed as the best available alternative. Results from sensitivity analyses indicate that additional information is needed to evaluate the alternative hypotheses for plant root uptake of buried wastes. Site-specific evaluations of the contribution from biotic transport to the potential dose to man establish the relevance in the assessment process. The BIOPORT/MAXI1 computer software package is proposed for dose assessments of commercial low-level waste disposal sites.

8998 (NUREG/CR—4720) **Compilation of field-scale caisson data on solute transport in the unsaturated zone.** Polzer, W.L.; Essington, E.H.; Fuentes, H.R.; Nyhan, J.W. (Los Alamos National Lab., NM (USA)). Nov 1986. Contract W-7405-ENG-36. 193p. (LA—10798-MS). NTIS, PC A09/MF A01 - GPO. File Number TI87002948.

Los Alamos National Laboratory has conducted technical support studies to assess siting requirements mandated by Nuclear Regulatory Commission in 10 CFR Part 61. Field-scale transport studies were conducted under unsaturated moisture conditions and under steady and unsteady flow conditions in large caissons located and operated in a natural (field) environment. Moisture content, temperature, flow rate, base-line chemical, tracer influent, and tracer breakthrough data collected during tracer migration studies in the caisson are compiled in tables and graphs. Data suggest that the imposition of a period of drainage (influent solution flow was stopped) may cause an increase in tracer concentration in the soil solution at various sampling points in the caisson. Evaporation during drainage and diffusion of the tracers from immobile to mobile water are two phenomena that could explain the increase. Data also suggest that heterogeneity of sorption sites may increase the variability in transport of sorbing tracers compared with nonsorbing tracers.

8999 (RHO-RE-SR—86-24P) **Results of the Separations Area ground-water monitoring network for 1985.** Law, A.G.; Schatz, A. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jul 1986. Contract AC06-77RL01030. 163p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87002753.

The purpose of this report is to present a summary of the results for calendar year 1985 of the Rockwell Hanford Operations (Rockwell) groundwater monitoring program for the Separations Area of the Hanford Site. The objectives of the monitoring program are to (1) evaluate the quality of ground water for compliance with Rockwell and DOE guidelines, (2) assess the performance of waste disposal and storage sites in the Separations Area, (3) determine the impact of waste disposal operations on the ground water, and (4) provide data for hydrologic analyses and model application. The 1985 Separations Area unconfined aquifer monitoring network included 127 wells. Water samples were collected monthly, quarterly, or semiannually from the wells in the network. These samples were selectively analyzed for total alpha, total beta, tritium, ^{90}Sr, ^{137}Cs, ^{60}Co, ^{106}Ru, uranium, and nitrate. Average radionuclide concentrations in monitoring wells for 1985 were similar to 1984, with the exception of wells at the 216-U-1/2 cribs. Water levels were measured in 224 wells to produce water table maps of the Separations Area (annually) and of the Hanford Site (semiannually). Radionuclide concentrations in the ground water within the Separations Area are compared with the Rockwell internal guidelines of RHO-MA-139, Environmental Protection Manual, Part L, which are applicable at the waste sites. These guidelines have their basis in DOE orders. The comparisons are conservative for the Separations Area since concentrations would be reduced by sorption, dispersion, dilution, and decay by the time flow reached the site boundary. Tritium, which is controlled on the basis of discharge concentrations, did not exceed the radioactivity levels specified in RHO-MA-139. Cases where guidelines were exceeded at active liquid waste disposal facilities and inactive facilities are reported.

0540 Health And Safety

REFER ALSO TO CITATION(S) 8913, 8914, 8915, 8941, 8968, 8969, 8970, 8971, 8972

9000 (DOE/RW—0119) **OCRWM [Office of Civilian Radioactive Waste Management] Safety Plan.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Dec 1986. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003611.

The OCRWM Safety Plan sets forth management policies and general requirements for the safety of the public and of personnel associated with the Civilian Radioactive Waste Management Program (hereinafter called the "Program"). It is applicable to all individuals and organizational elements of the Program, including all facilities and activities controlled by the Program pursuant to the Act, and to all phases of the Program. The plan defines the responsibilities assigned by the Director of the OCRWM to the various OCRWM line organizations, and to the contractors and the projects. It discusses the means by which safety policies and requirements will be communicated, and summarizes the applicable DOE Orders, and the procedures for reviewing, reporting, and evaluating safety problems. In addition, the OCRWM Safety Plan addresses DOE Orders applicable to occupational health and safety, worker protection, and public health and safety. OCRWM believes that it has an equally high level of commitment to both public safety and worker safety. The Plan also summarizes applicable NRC criteria and regulations that will be imposed through the formal licensing proceedings. While the Safety Plan sets forth OCRWM policy, it is not intended to be prescriptive in the details of implementation. Each OCRWM program element must develop and control its own set of detailed requirements for the protection of its workers and the public based on the principles set forth herein.

9001 (EGG—10282-1129) **Developing a comprehensive and accountable database after a radiological accident.** Berry, H.A.; Burson, Z.G. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). Sep 1986. Contract AC08-83NV10282. 4p. (CONF-8609147—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002858.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

After a radiological accident occurs, it is highly desirable to promptly begin developing a comprehensive and accountable environmental database both for immediate health and safety needs and for long-term documentation. The need to assess and evaluate the impact of the accident as quickly as possible is always very urgent, the technical integrity of the data must also be assured and maintained. Care must therefore be taken to log, collate, and organize the environmental data into a complete and accountable database. The key components of the database development are summarized as well as the experience gained in organizing and handling environmental data acquired during: (1) TMI (1979); (2) the St. Lucie Reactor Accident Exercise (through the Federal Radiological Measurement and Assessment Center (FRMAC), March 1984); (3) the Sequoyah Fuels Inc., uranium hexafluoride accident near Gore, Oklahoma (January 1986); and (4) Chernobyl reactor accident in Russia (April 1986).

9002 (FMPC—2048) **Feed Materials Production Center environmental, safety and health management plan: (Revision to NLCO-2037 preliminary).** Loudin, D.J. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). Sep 1986. Contract AC05-86OR21600. 178p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87003125.

The Feed Materials Production Center (FMPC) produces uranium metal for DOE defense programs at the Washington and South Carolina reactor sites, and DOE facilities elsewhere. Since the FMPC produces uranium metal products in support of various DOE defense programs, it is important that the FMPC maintain high standards of operation in a safe and environmentally compatible manner. This Environmental, Safety and Health (ES and H) Management Plan is a vital initial step to bring together all of the ES and H programs as an integrated plan which meets site ES and H concerns, and supports continued operations to fulfill FMPC mission requirements. The ES and H Management Plan report explains the FMPC mission and history, describes the site and surrounding area, and details the purpose and organization of the report; describes Air Pollution Control, Water Pollution Control, Solid Waste Management, and the Remedial Action Plan at the FMPC; describes the Safety Analyses program, Health Physics/Radiation Protection, Nuclear Criticality Prevention, Industrial Hygiene, and Safety/Fire Protection programs; and describes the FMPC Emergency Preparedness Plan.

9003 (INIS-mf—10514, pp vp) **Safety assessment of a projected waste repository for HLW during its operational phase.** Jacobi, A. Jr. (Nuclear Division, Electrowatt Engineering Services Ltd., Zurich, Switzerland). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9004 (INIS-mf—10514, pp vp) **Compliance of the Vaalputs radioactive waste disposal facility to a frequency-magnitude release criterion as required for licensing.** Adrian, H.W.W.; Gerber, H.H.; Kruger, J.; Weygand, J. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9005 (INIS-mf—10514, pp vp) **Methodology for performing safety assessments for potential radioactive waste disposal facilities.** Fitzpatrick, J.; Gralewski, Z.A.; Vande Putte, D.; Waplington, G. (Electrowatt Engineering Services Ltd., Horsham, UK). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9006 (INIS-mf—10514, pp vp) **Probability of intrusion events at radioactive waste disposal facilities.** Sandquist, G.M.; Rogers, V.C. (Utah Univ., Salt Lake City, USA; Rogers and Associates Engineering Corp., Salt Lake City, UT, USA). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9007 (INIS-mf—10514, pp vp) **Safety assessment for radwaste disposal in Korea: Pt. 1. Development of a code for a simplified safety analysis.** Suh, I.S.; Park, H.H.; Han, K.W.; Hahn, P.S. (Korea Advanced Energy Research Inst., Daeduk, Republic of Korea). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9008 (PNL-SA—13389) **Performance testing of workplace air monitors using procedures based on draft ANSI N42.17B.** Kenoyer, J.L.; Higby, D.P.; Swinth, K.L.; Mishima, J.; Selby, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1986. Contract AC06-76RL01830. 17p. (CONF-8610170—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001802.

From Department of Energy's workshop on workplace aerosol monitoring; Napa, CA, USA (29 Oct 1986).

The performance of commercially available continuous air monitors used in the workplace to monitor levels of airborne particulates (alpha, beta/photon emitters) was evaluated by personnel at the Pacific Northwest Laboratory. Testing procedures are based on criteria and methods in draft ANSI N42.17B, "Performance Specifications for Health Physics Instrumentation - Occupational Airborne Radioactivity Monitoring Instrumentation." Testing requirements and results are discussed for the following tests: stability; effects of temperature, humidity, and ambient pressure; alarm threshold drift; coefficient of variation; response time; energy dependence; and air flow rate accuracy. Tests results show that certain systems may show large temperature, humidity, or ambient pressure effects; interference effects from radio frequency fields; very slow response times; a large beta-energy dependence; or a saturation problem in high-exposure conditions. Systems performed well when compared to stability, alarm threshold drift, and air flow rate accuracy criteria. 2 refs., 5 figs., 5 tabs.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 8938, 8965, 9005

9009 (AECL—8855) **CANDU irradiated fuel safeguards sealing system at the threshold of implementation.** Stirling, A.J.; Kupca, S.; Martin, R.E.; West, R.J.; Aikens, A.E.; Cox, C.A.; White, B.F.; Smith, M.T.; Payne, W.E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1985. 14p. (CONF-850765—43). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700478.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

The development of a safeguards containment and surveillance system for the irradiated fuel discharged from CANDU nuclear generating stations has inspired the development of three different sealing technologies. Each seal type utilizes a random seal identity of different design. The AECL Random Coil (ARC) Seal combines the identity and integrity elements in the ultrasonic signature of a wire coil. Two variants of an optical seal have been developed which features identity elements of crystalline zirconium and aluminum. The sealed cap-seal uses a conventional IAEA 'Type X Seal' (wire seal). The essential features and relative merits of each seal design are described.

9010 (AECL—8856) **Experience with an ultrasonic sealing system for nuclear safeguards in irradiated fuel bay demonstrations.** White, B.F.; Smith, M.T.; Keeffe, R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1985. 12p. (CONF-850765—44). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700479.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

The development of the irradiated fuel safeguards containment assembly for CANDU nuclear generating stations has stimulated the development of the AECL Random Coil Sealing System. The ARC seal combines the identity and integrity elements in an ultrasonically-determined signature. This is verified in situ, in real time with the seal reading system. The maturation of this technology has been facilitated with demonstration trials in the NRU and NPD irradiated fuel bays. The NPD demonstration includes operation of the systems tooling by Ontario Hydro staff. It provides the opportunity for IAEA inspectors from Toronto and Vienna to direct the operational procedures and to perform the data acquisition. The procedures and systems developed in these trials are reviewed. The estimation of the system performance characteristics from the observations is presented. A minimum frequency of reading for individual seals is recommended to be once per annum following initial deployment.

9011 **(BNL—38584) A study of a zone approach to IAEA [International Atomic Energy Agency] safeguards: The low-enriched-uranium zone of a light-water-reactor fuel cycle.** Fishbone, L.G.; Higinbotham, W.A. (Brookhaven National Lab., Upton, NY (USA). Technical Support Organization). Jun 1986. Contract AC02-76CH00016. 181p. (ISPO—196; TSO—86-15). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87003224.

At present the IAEA designs its safeguards approach with regard to each type of nuclear facility so that the safeguards activities and effort are essentially the same for a given type and size of nuclear facility wherever it may be located. Conclusions regarding a state are derived by combining the conclusions regarding the effectiveness of safeguards for the individual facilities within a state. In this study it was convenient to define three zones in a state with a closed light-water-reactor nuclear fuel cycle. Each zone contains those facilities or parts thereof which use or process nuclear materials of the same safeguards significance: low-enriched uranium, radioactive spent fuel, or recovered plutonium. The possibility that each zone might be treated as an extended material balance area for safeguards purposes is under investigation. The approach includes defining the relevant features of the facilities in the three zones and listing the safeguards activities which are now practiced. This study has focussed on the fresh-fuel zone, the several facilities of which use or process low-enriched uranium. At one extreme, flows and inventories would be verified at each material balance area. At the other extreme, the flows into and out of the zone and the inventory of the whole zone would be verified. There are a number of possible safeguards approaches which fall between the two extremes. The intention is to develop a rational approach which will make it possible to compare the technical effectiveness and the inspection effort for the facility-oriented approach, for the approach involving the zone as a material balance area, and for some reasonable intermediate safeguards approaches.

9012 **(DOE/DP—0035) Safeguards seal reference manual.** (Battelle Columbus Labs., OH (USA)). Dec 1986. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003679.

The purpose of this manual is to assist nuclear facility personnel in selecting, procuring, and applying the proper seals for safeguarding nuclear material. The intent is not to give detailed, step-by-step procedures for developing a safeguards seal system for a facility; instead, the goal is to provide information which will allow such a system to be developed and implemented by a facility to meet its site-specific requirements. The manual will help the user to develop a seal system that can be integrated with other elements of a safeguards system. Typical applications, selection criteria, general application procedures, and identification of commercial sources of seals are provided. The intent of this manual is to complement DOE Order 5630.2. However, if conflicts arise between this manual and the DOE order, the order shall prevail.

9013 **(INIS-XN—30) Radiation Ordinance 1983 (No. 58 of 1983) (Australian Capital Territory).** (International Atomic Energy Agency, Vienna (Austria)). 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700298.

This Ordinance provides for the safe use, transportation and disposal of radioactive materials and irradiating apparatus. It repeals the Fluoroscopes Ordinance of 1958. Radioactive materials whose radioactivity does not exceed levels as set out in a Schedule to the Ordinance are exempted from application of the Ordinance.

9014 **(K/HS—9) Cascade Complex Inventory Difference Study Committee: Mass Measurement Subcommittee: RMS [Replicate Mass Standards] weighing.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 8 Jun 1983. Contract AC05-84OT21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003311.

The subcommittee's purpose was to discuss present mass measurement methods and to propose a program for mass assurance. The goal was to provide information needed to evaluate shipper-receiver (S-R) differences between the gaseous diffusion plants. As part of the work to meet this goal a stainless steel replicate of a model 48Y cylinder was circulated among the diffusion plants for test weighings. This report describes the weighing test and the results of this test. The stainless steel cylinder weighed was one of the Replicate Mass Standards (RMS) as described in ANSI Standard N15.18-1975 titled Mass Calibration Techniques for Nuclear Material Control. This cylinder, number RMS-5, had its mass established by the National Bureau of Standards (NBS) in 1977. The cylinder, RMS-5 was shipped to each gaseous diffusion plant (GDP) and weighed on each scale used for interplant cylinder flows and other scales as desired. The test weighings were to be made twice a day for five days. This exercise allowed estimates of the parameters, scale bias, and scale process standard deviation to be madw which is the type of information needed to evaluate shipper-receiver differences. The main problem was the quantity (i.e. number of weighings) of information used for these estimates. Because of the small sample size the parameters estimated should be considered rough estimates. These estimates should also be estimated from check weight data available at each GDP. Using this data would allow more information for the bias and standard deviation estimates. In addition actual S-R differences can be used as a verification that the scale parameters are as stated and remain constant.

9015 **(K/OA—5826) A 20-ton-capacity load-cell-based weighing system for UF_6 cylinder mass verifications.** McAuley, W.A.; Kane, W.R.; Fainberg, A. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Brookhaven National Lab., Upton, NY (USA)). 8 Jan 1985. Contract AC05-84OT21400. 13p. (CONF-850210—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002803.

From 12. annual WATTec energy conference and exhibition; Knoxville, TN, USA (12 Feb 1985).

To provide for the verification of UF_6 cylinder masses by the International Atomic Energy Agency at uranium enrichment facilities handling large-capacity UF_6 cylinders, an 18.14-metric-ton-capacity (20-ton) Load-Cell-Based Weighing System (LCBWS) has been developed. This system, which was developed at Brookhaven National Laboratory and the Oak Ridge Gaseous Diffusion Plant (ORGDP) and calibrated at the US National Bureau of Standards, is described along with results from its initial testing. The principal components of the LCBWS are two 11.34-metric-ton-capacity (12.50-ton) load cells (with associated readout and ancillary equipment) and a lifting fixture that couples the load cells to a UF_6 cylinder. Results from testing of the system at the ORGDP followed by a comparative analysis of the apparent cylinder masses vs brass given by the LCBWS with the stated ORGDP accountability scale values indicates that the accuracy of the LCBWS is +- 1 kg and that the precision of an individual measurement is +- 2 kg. Initial experience wth the 18.14-metric-ton-capacity (20-ton) LCBWS indicates that it has the advantages of portability, ease of assembly and use, and high accuracy. Further testing to establish the long-term stability of the calibration and overall reliability of the system is described along with future work for the redesign of the system's readout and ancilliary equipment to ensure that a user-friendly interface for operations is available.

9016 **(K/OA—6009) UF_6 cascade header pipe test loop for international enrichment plant safeguards.** Cooley, J.N.; Fields, L.W.; Swindle, D.W. Jr. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oct 1986. Contract AC05-84OT21400. 16p. (IAEA-SM—293/128; CONF-861104—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002524.

From International symposium on nuclear material safeguards; Vienna, Austria (10 Nov 1986).

A functional UF_6 test loop capable of simulating operating flows, pressures, and pipe deposits characteristic of gas centrifuge enrichment plant piping has been designed and fabricated by the Enrichment Safeguards Program at Martin Marietta Energy Systems, Inc., for use by the International Atomic Energy Agency (IAEA) at its Safeguards Analytical Laboratory (SAL) in Seibersdorf, Austria. The purpose of the test loop is twofold: (1) to enable the IAEA to evaluate and to calibrate enrichment safeguards measurement instrumentation to be used in limited frequency-unannounced access (LFUA) inspection strategy measurements at gas centrifuge enrichment plants and (2) to train IAEA inspectors in the use of such instrumentation. The test loop incorporates actual sections of cascade header pipes from the centrifuge enrichment plants subject to IAEA inspections. The test loop is described and applications for its use by the IAEA are detailed. By giving the Agency the in-house capability to evaluate LFUA inspection strategy approaches, to develop inspection procedures, and to train inspectors, the UF_6 cascade header pipe test loop will enable the IAEA to successfully implement LFUA strategy inspections at gas centrifuge enrichment facilities subject to international safeguards inspections.

9017 **(KFK—4077) Study on the DoD-method of measurement data evaluation.** Beyrich, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Entwicklungsabteilung Kernmaterialsicherung). Aug 1986. 18p. (EUR—9616e). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750326.

The DoD-method (Distribution of Differences) for measurement data evaluation allows meaningful estimation of variances or standard deviations without the necessity to reject outlier values. It has been developed at KfK in particular for evaluating analytical data. The basic elements used for statistical treatment are all D=(N-1)*N/2 absolute differences that can be formed between N measurement values. For N<=10 it is shown that the D absolute differences can be divided into (N-1) subgroups, each of them consisting of N/2 stochastically independent elements. Furthermore, a relationship is given between the estimates for the standard deviations of the subgroups and the estimate for the standard deviation of the total group of absolute differences. Numerical examples are presented.

9018 **(MLM—3408(OP)) The use of radiometric calorimeters in a glovebox environment.** Mayer, R.L. II; Duff, M.F. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1986. Contract AC04-76DP00053. 11p. (IAEA-SM—293/125; CONF-861104—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003022.

From International symposium on nuclear material safeguards; Vienna, Austria (10 Nov 1986).

The use of radiometric calorimeters in a glovebox environment requires that special consideration be given to instrument design, measurement methodology, and measurement control. The measurement system described in this paper consists of five radiometric calorimeters installed in production facility glovebox lines at Mound, a US Department of Energy contractor-operated facility.

9019 **(MLM—3409-OP) In-field calibration of neutron correlation counters via calorimetry and high count rate gamma-ray isotopics measurements.** Rakel, D.A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1986. Contract AC04-76DP00053. 18p. (IAEA-SM—293/126; CONF-861104—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003023.

From International symposium on nuclear material safeguards; Vienna, Austria (10 Nov 1986).

The use of transportable calorimetric assay equipment to perform an in-field calibration of a neutron correlation counter is presented. During the past three years, this combination of instrumentation has been used to measure the plutonium content of a variety of oxide, salt, and metal samples. An increase in sample throughput has been achieved by using this combination of measurements.

9020 **(PNL-SA—14371) Safeguards training at Pacific Northwest Laboratory.** Dickman, D.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 7p. (CONF-8610178—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002473.

From TRADE conference; Las Vegas, NV, USA (27 Oct 1986).

Safeguarding our country's nuclear materials against theft or diversion is extremely important due to their significantly strategic value. In addition, nuclear materials also have an extremely high monetary value. The term "safeguards" is defined as an integrated system of physical protection, accountability, and material control measures designed to deter, prevent, detect, and respond to unauthorized possession and use of special nuclear materials. An aggressive Safeguards program, therefore, employs both good security measures and a strong material control and accountability system. For effective internal control of nuclear materials, having people qualified in the many aspects of safeguards and accountability is essential. At Pacific Northwest Laboratory (PNL), this goal is accomplished through a Laboratory-wide Safeguards Awareness Program. All PNL staff members receive a level of Safeguards training appropriate to their particular function within the Laboratory. This paper presents an overview of the unique training opportunities this topic provides and how the training goals are accomplished through the various training courses given to the staff members.

9021 **(PNL-SA—14402) Uncertainty estimates for calibration measurements.** Liebetrau, A.M.; Goldman, A.S.; Aparo, M. (Pacific Northwest Lab., Richland, WA (USA); Los Alamos National Lab., NM (USA); ENEA, Rome (Italy)). Oct 1986. Contract AC06-76RL01830. 27p. (CONF-861104—13; IAEA-SM—293/81). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003097.

From International symposium on nuclear material safeguards; Vienna, Austria (10 Nov 1986).

The volume of liquid in a process tank is typically determined from a calibration function that relates tank volume to some measure of liquid height. This calibration equation is determined from data acquired during one or more calibration runs. Solutions are proposed for two statistical problems that arise when the calibration function is derived and used: that of computing plausible variance estimates if the data exhibit statistically significant run-to-run differences and that of computing confidence intervals that hold simultaneously for an arbitrary number of volume determinations. When statistically significant run-to-run differences are ignored and standard statistical procedures are applied to data, resulting variance estimates can seriously underestimate actual measurement variability. In the proposed procedure, the variance of a predicted new response is estimated as the sum of two components: one due to run-to-run differences and one due to the fitted model. Depending upon the nature of the model(s) required to fit the data, estimates of the response variance components take one of three forms. For linear functions, estimates of component variances are derived from sums of squares that are computed during an analysis of covariance. The estimated calibration function is used to determine the volumes that correspond to observed liquid heights. Confidence intervals are required that hold simultaneously for arbitrarily many volume determinations. A procedure for computing simultaneous discrimination intervals employs variance estimates computed as described above in Scheffe-type simultaneous prediction intervals. These intervals are combined with tolerance intervals on the response variable to obtain equations that can be solved to obtain the desired discrimination intervals for volume determinations.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

9022 (ZfI-Mitt—110, pp 4-225) **Methods of ^{15}N tracer research in biological systems.** Hirschberg, K.; Faust, H. Dec 1985. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87780039.

In Report of the Central Institute for Isotope and Radiation Research.

The application of the stable isotope ^{15}N is of increasing importance in different scientific disciplines, especially in medicine, agriculture, and the biosciences. The close correlation between the growing interest and improvements of analytical procedures resulted in remarkable advances in the ^{15}N tracer technique. On the basis of the latest results of ^{15}N tracer research in life sciences and agriculture methods of ^{15}N tracer research in biological systems are compiled. The ^{15}N methodology is considered under three headings: Chemical analysis with a description of methods of sample preparation (including different separation and isolation methods for N-containing substances of biological and agricultural origin) and special procedures converting ammonia to molecular nitrogen. Isotopic analysis with a review on the most important methods of isotopic analysis of nitrogen: mass spectrometry (including the GC-MS technique), emission spectrometry, NMR spectroscopy, and other analytical procedures. ^{15}N-tracer techniques with a consideration of the role of the isotope dilution analysis as well as different labelling techniques and the mathematical interpretation of tracer data (modelling, N turnover experiments). In these chapters also sources of errors in chemical and isotopic analysis, the accuracy of the different methods and its importance on tracer experiments are discussed. Procedures for micro scale ^{15}N analysis and aspects of ^{15}N analysis on the level of natural abundance are considered. Furthermore some remarks on isotope effects in ^{15}N tracer experiments are made. 405 refs., number index, author index, subject index.

9023 **(ZfI-Mitt—110) Report of the Central Institute for Isotope and Radiation Research.** (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Dec 1985. 267p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87780039.

Individual items in scope are processed separately. (DLC)

0701 Physical Isotope Separation

9024 (CERN—86-05) **ISOLDE Users' Guide.** Kluge, H.J. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 18 Jul 1986. 302p. NTIS (US Sales Only), PC A14/MF A01. File Number DE87700274.

The ISOLDE Users' Guide gives the necessary information on planning and performing experiments at the on-line isotope separation facility ISOLDE which uses the 600 MeV synchro-cyclotron at CERN as a dedicated injector. The report is divided into three parts. A short description of the ISOLDE facility, the procedure for making proposals, and some practical information are given in Part 1. Part 2 contains the summaries of the proposals together with a compilation of publications of ISOLDE work since about 1980 which allow the reader to obtain a survey of the current research programme. Part 3 comprises a compilation of measurements of the production yields of the radioactive isotopes of the 66 elements which are available as on-line beams at ISOLDE.

9025 **(N—86-33259) Radioactivities in returned lunar materials and in meteorites. Semiannual progress report, 1 August 1985-31 July 1986.** Fireman, E.L. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Aug 1986. 18p. (NASA-CR—179743; NAS—1.26:179743; SAPR—6; SAPR—7). NTIS HC A02/MF A01.

A preliminary C-14 study on lunar soil was carried out with the University of Toronto Iso Trace accelerator mass spectrometer. After the preliminary study using CO_2 from 10084,937 soil, which had previously been counted with low-level mini-proportional counters, it became clear that the Toronto accelerator could carry out C-14/C-13/C-12 ratio measurements on 1 gram meteorite and lunar samples and that the C-14 measurements are done with higher precision and better reliability than elsewhere. Arrangements have been made for Dr. R.P. Beukens of the Toronto Accelerator Group to extract the carbon compounds from Antarctic meteorite and lunar samples and to convert the compounds to CO_2. During the past two years, a uranium-series dating method was developed for polar ice, which method is being applied to ice from the Allan Hills site, Byrd core, and the Beardsmore glacier.

0702 Radiation Sources

9026 (Juel-Spez—316, pp 186-187) **Considerations to a cooling ring for neutrons.** Rauch, H.; Chorherr, T.; Weinfurter, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

08 HYDROGEN

0801 Production

9027 **(BMFT-FB-T—86-074) Production of hydrogen by solar induced redox reaction in microheterogeneous systems. Final report.** Hoffmann, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)). Sep 1986. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750794.

Experimental results obtained by bench scale experiments in order to split water photochemically into hydrogen and oxygen were examined from the viewpoint of technical realization and availability. Specific catalyst carriers based upon titanium dioxide (anatase-, rutile- and amorphous structures) could be produced in a reproducible way. Various catalysts were deposited with different methods and characterized extensively (atomic absorption, X-ray fluorescence, electron microscopy, ESCA measurements). Ordinary and functionalized sensitizers were tested. The photocatalytic activity for water reduction and oxidation was determined in various systems with emphasis on the oxidation step. Water splitting into hydrogen and oxygen was confirmed. Microheterogeneous systems for solar hydrogen production seem to be competitive if compared with photovoltaic driven water electrolysis systems. With 15 refs., 8 tabs., 35 figs.

9028 **Cobalt-catalyzed evolution of molecular hydrogen.** Connolly, P.; Espenson, J.H. (Iowa State Univ., Ames). *Inorganic Chemistry;* 25: No. 16, 2684-2688(30 Jul 1986). Contract W-7405-ENG-82.

Solutions of chromium(II), europium(II), or vanadium(II) chloride in hydrochloric acid evolve molecular hydrogen rapidly in the presence of trace concentrations of the cobalt(II) macrocycle $Co(dmgBF_2)_2$. The stoichiometry for Cr(II) corresponds to the net reaction $Cr^{2+} + Cl^- + H^+ = CrCl^{2+} + 1/2H_2$. The kinetics are described quite adequately by the Michaelis-Menton scheme. Kinetic studies of the reaction were during the pre-steady-state phase, during which an intensely absorbing intermediate forms, and also at longer times during the steady-state phase when the pseudo-steady-state concentration of the intermediate slowly declined as the substrate was consumed. Arguments are given in support of the intermediate being $[(H_2O)_5Cr\text{-}Cl\text{-}Co(dmgFB_2)_2]\mu$. Its dissociation leads, in acidic solution, to the hydridocobalt complex $HCo(dmgBF_2)_2$, which is responsible for H_2 formation. Bromide ions, but not perchlorate, also give catalytic H_2 production, whereas iodide forms a ternary complex that does not decompose. 27 references, 8 figures, 1 table.

9029 **The direct use of natural gas (methane) for conversion of carbonaceous raw materials to fuels and chemical feedstocks.** Steinberg, M. (Process Sciences Div., Dept. of Applied Science, Brookhaven National Lab., Upton, NY 11973). pp 217-228 of Hydrogen systems. Veziroglu, T.N.; Zhu, Y.; Bao, D. Elmsford, NY; Pergamon Press (1985). (CONF-850512—).

From Beijing international symposium on hydrogen systems; Beijing, China (7 May 1985).

It appears that natural gas is almost as abundant as petroleum, if not more so, as a natural resource in many parts of the world. Because of its rich hydrogen content, it is probably the lowest cost source of hydrogen wherever it is available. The most abundant fossil energy resource in the world appears to be coal, and the most abundant renewable resource appears to be biomass (trees and plants), both of which contain a deficiency of hydrogen. It is proposed to use natural gas in conjunction with coal and biomass to produce the preferred liquid fuel simulating petroleum products. Processes are described which include methanolysis that is the direct use of methane for gasification and liquefaction of coal and biomass, and for desulfurization of coal derived liquid and gases. The thermal decomposition of methane is described for hydrogen and carbon particulate production. A cyclical process is described for producing a clean particulate carbon from coal for use in a carbon-water-fuel-mix as a substitute diesel fuel or premium-grade boiler fuel. The hydrogen from methane can be used for flash hydropyrolysis or can be used to produce ammonia fertilizer.

0802 Storage

9030 (INIS-mf—10512, pp 14) **Hydrogen in metals - fundamentals and applications.** Wiesinger, G. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9031 (MLM—3399(OP)) **Disproportionation of A1-modified $LaNi_5$ alloys by repeated H_2 absorption and desorption.** Abell, G.C.; Rutherford, W.M.; Love, C.M.; Evans, R. III; Cantrell, J.S. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; Miami Univ., Oxford, OH (USA)). 1986. Contract AC04-76DP00053. 18p. (CONF-8610177—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003025.

From Solid science meeting; Livermore, CA, USA (6 Oct 1986).

Development of chemical compressors for H_2 processing based on the use of reversible metal hydrides, was stimulated by the discovery of novel alloy hydrides, especially $LaNi_5$-based alloys. These latter alloys are easily activated, have good capacity (H/M $\approx$ 1), provide a useful range of equilibrium H_2 plateau, and are resistant to O_2 and H_2O poisoning. However, they tend to disproportionate toward more stable (and thus less reversible) hydrides when subjected to repeated H_2 absorption/desorption cycles. We have developed a closed loop H_2 cycling apparatus, supervised and monitored by an IBM PC. This paper describes the system and discusses results obtained for $LaNi_5$, LaNi/sub 4.7/Al/sub 0.3/, and LaNi/sub 4.5/Al/sub 0.5/. The results include change of H/M capacity with cycling and postmortem x-ray analyses.

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 9333

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 9048

9032 (DOE/ID/12493—T1) **Del Valle Hog Farm energy integrated farm system: Phase 3, Demonstration: Final report.** Berdoll, D. (Del Valle Hog Farm, TX (USA)). Aug 1985. Contract AC07-84ID12493. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003117.

The Energy Integrated Farm System located at the Del Valle Hog Farm has as its objectives the determination and demonstration of the technical and economical feasibility of methane production derived from the anaerobic digestion of swine manure and the reliability of this process as an alternate energy source for the production of fuel alcohol, electricity, and concentrated space heating. Manure from the 150 sow farrow-to-finish swine operation is used as the feedstock for the 4000 ft^3 anaerobic digestion system. The approximately 6000 ft^3 of methane-rich biogas produced daily is stored under pressure for ultimate usage throughout the integrated farm system. Large quantities of biogas are utilized directly for space heating of the farrow and nursery buildings. Additionally biogas is combusted in a motor generator for the production of electrical energy. The excess quantity of biogas produces the thermal energy necessary in the fuel alcohol facility for converting the starches in the feedstock grain sorghum into fermentable sugars and for concentrating the product alcohol through the distillation process. The fuel alcohol produced fuels for farm vehicles. A valuable by-product of the anaerobic digestion process, the digested inert and odorless sludge, is utilized as a fertilizer substitute and soil amendment on both coastal Bermuda grass and milo grain sorghum. Economic analyses performed on the various components of the integrated farm system illustrate fuel costs comparable with that of replacement fuels in 1984 dollars improving throughout the useful life of the particular energy component. 15 refs., 52 figs., 17 tabs.

9033 (DOE/PC/70028—T8) **Improved catalysts for liquid hydrocarbon fuels from syngas. Seventh quarterly technical progress report, April-June 1986.** (Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center). 1986. Contract AC22-84PC70028. 204p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE87000519.

This report describes the five catalyst tests conducted from April through June 1986, the seventh quarter of this contract. A list of the catalysts tested, a description of their preparation, and a brief statement of each test's objective, are shown in Table A1. All of the catalysts tested involved cobalt oxide and additive X_{11} intimately contacted with one of two Molecular Sieve supports: TC-123 in Runs 57, 59, 60, and TC-124 in Runs 58 and 61. Runs 57 and 60 were designed to assess the effects of the promoter X_9, which was first used in combination with the X_{11} promoter in Run 55 (described in Appendix B of this report). Run 59 tested a new method of increasing the cobalt concentration in the catalyst. Runs 58 and 61 examined the use of the newly developed catalyst support, TC-124. An abbreviated table of results for these catalyst runs is shown in Table A2. The conversion, weight percent CH_4, weight percent C_5^+, and specific activity, as well as a qualitative estimate of stability, are listed for each catalyst. A more complete report of results and analysis of these runs will be presented in the Eighth Quarterly Report.

9034 (DOE/PC/70028—T9) **Improved catalysts for liquid hydrocarbon fuels from syngas: Technical progress report: Eighth quarterly report, July-September 1986.** (Union Carbide Corp., Tarrytown, NY (USA). Catalysts and Services Div.). 1986. Contract AC22-84PC70028. 291p. NTIS, PC A13. File Number DE87002637.

This report describes the six catalyst tests conducted from July through September 1986, the eight quarter of this contract. A list of the catalysts tested, a description of their preparation, and a brief statement of each test's objective, are shown in Table A1. All of the catalysts tested involve promoted or non-promoted cobalt oxide intimately contacted with various Molecular Sieve supports. Three of the runs (62, 64, 66) investigated the use of the new Molecular Sieve components TC-201, TC-211 and TC-12365. Run 63 looked at the performance of the promising $Co/X_{11}/X_9/TC$-123 Catalyst 55 under conditions of 250C, 400 psig and 1.5:1 H_2:CO. Run 65 investigated the additive effects of the promoters X_{11} and X_9, and Run 67 tested a change in the calcination procedure on catalyst performance. An abbreviated table of results for these catalyst runs is shown in Table A2. The conversion, weight percent CH_4, weight percent C_5^+, and specific activity, as well as a qualitative estimate of stability, are listed for each catalyst.

9035 **The sampleless laboratory.** Gibbon, G.A.; Hackett, J.P. (U.S. Dept. of Energy, Pittsburgh Energy Technology Center, P.O. Box 10940, Pittsburgh, PA 15236). pp 909 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

One of the least considered errors in any analytical scheme is the process of removing a sample from a vessel or line and transferring the sample to the analytical laboratory. The representativeness of the sample taken, the possibility of change in composition of the sample before analysis, the difficulty in correctly aliquoting the sample in the laboratory, and the correct introduction of the sample into the analytical measurement system are all factors which must be dealt with in planning the analysis. An alternative strategy is the use of on-line analysis. The problems mentioned above are either minimized or eliminated. In addition, it is frequently possible to obtain results in a time frame that is much better related to the actual process. In the limiting case, on-line analysis may take the place of process control analyses or quality control analyses with a resulting savings in effort and cost. This paper describes the development of an on-line gas chromatographic method for the analysis of the products from the Fischer-Tropsch reaction. The work was done as part of the research effort at the Pittsburgh Energy Technology Center to develop new processes for the Fischer-Tropsch reaction.

9036 **Flash hydropyrolysis and methanolysis of biomass with hydrogen and methane.** Steinberg, M. (Process Sciences Div., Dept. of Applied Science, Brookhaven National Lab., Upton, NY 11973). pp 229-256 of Hydrogen systems. Veziroglu, T.N.; Zhu, Y.; Bao, D. Elmsford, NY; Pergamon Press (1985). (CONF-850512—).

From Beijing international symposium on hydrogen systems; Beijing, China (7 May 1985).

The process chemistry of the flash pyrolysis of biomass (wood) with the reactive gases, H/sub 2/ and CH/sub 4/ and with the non-reactive gases He and N/sub 2/ is being determined in a 1 in. downflow tubular reactor at pressures from 20 to 1000 psi and temperatures from 600 to 1000°C. With hydrogen, flash hydropyrolysis leads to high yields of methane and CO which can be used for SNG and methanol fuel production. With methane, flash methanolysis leads to high yields of ethylene, benzene and CO which can be used for the production of valuable chemical feedstocks and methanol transportation fuel. At reactor conditions of 50 psi and 1000°C and approximately 1 sec residence time, the yields based on pine wood carbon conversion are up to 30% for ethylene, 25% for benzene, and 45% for CO, indicating that over 90% of the carbon in pine is converted to valuable products. Pine wood produces higher yields of hydrocarbon products than Douglas fir wood; the yield of ethylene is 2.3 times higher with methane than with helium or nitrogen, and for pine, the ratio is 7.5 times higher. The mechanism appears to be a free radical reaction between CH/sub 4/ and the pyrolyzed wood. There appears to be no net production or consumption of methane. A preliminary process design and analysis indicates an economically competitive system for the production of ethylene, benzene and methanol based on the methanolysis of wood.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 8822, 9036, 10008

9037 **(SERI/TP—231-3023) Production of butyl solvents from lignocellulose: An economic analysis.** Wright, J.D.; Daling, R.; Sandel, R.L.; Fitzpatrick, S.W. (Solar Energy Research Inst., Golden, CO (USA); Badger Engineers, Inc., Tampa, FL (USA)). Nov 1986. Contract AC02-83CH10093. 14p. (CONF-860826—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001121.

From National meeting of the American Institute of Chemical Engineers; Boston, MA, USA (24 Aug 1986).

A process is described that produces butyl solvents, butanol, isopropanol, and ethanol from wood or other lignocellulosic feedstock. Two new elements of technology introduced are the processing batch reactor developed at SERI that produces high yields of fermentable sugars (hexoses and pentoses) at the appropriate concentration for the butyl solvents fermentation and a novel method of separating products using liquid-liquid extraction, which reduces the separation energy required to about 30% of energy required in the conventional batch method. Economic analysis suggests that the project is attractive at a feedstock capacity of 400,000 dry MTA or larger (178 million lb/yr solvents). There are, however, uncertainties associated with the project because of the relatively early stage of development of the key elements of the process technology and the sensitivity of the DCFIROR to estimated capital cost. A further conclusion is that the process economics would benefit greatly from reduced capital cost of the fermentation section. This could perhaps be accomplished by developing a continuous fermentation process. Such fermentation technology has been demonstrated on laboratory scale, but as far as is known, has not been developed to pilot scale. 21 refs., 4 figs., 3 tabs.

9038 **Low temperature catalysts for methanol production.** Sapienza, R.S.; Slegeir, W.A.; O'Hare, T.E.; Mahajan, D. US Patent 4,623,634. 18 Nov 1986. Filed date 23 Dec 1985. v.p.

This patent describes a catalyst used in the synthesis of methanol from carbon monoxide and hydrogen which comprises catalytic amounts in slurry form of a complex reducing agent of the type NaH-ROH-M(OAc)/sub 2/. The M is selected from the group consisting of Ni, Pd, and Co and R is a lower alkyl group containing from 1-6 carbon atoms, combined with a group VI metal carbonyl.

0903 Inorganic Hydrogen Compound Fuels

9039 **Catalysts for synthesis of ammonia.** Ozyagcilar, M.N.; Davis, M.W. Jr. (to University of South Carolina, Columbia, SC). US Patent 4,623,532. 18 Nov 1986. Filed date 30 Jun 1983. v.p.

This patent describes a method of making ammonia which comprises the step of passing a feed mixture containing gaseous molecular nitrogen and hydrogen over a catalyst comprised of a binary alloy of iron and titanium. The catalyst is activated before being exposed to the reactant gases by exposure to gaseous hydrogen to remove impurities from the surface of the catalyst and to form at least one metal hydride.

0904 Solid Waste And Wood Fuels

9040 (CONF-8512105—, pp 25-29) **Formation and emission of pollutants in refuse incineration.** Vogg, H. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Based on the status of the art in municipal solid waste incineration technology problems are treated in more detail which are connected with pollutant generation, above all those related to emissions into the air path. The special role is underlined which the elements cadmium and mercury play among the heavy metals. Novel findings about the formation and destruction of dioxins in fly ashes from municipal solid waste incinerators are discussed.

13 HYDRO ENERGY

1306 Environmental Aspects

9041 **(DOE/BP/39830—2) Lower Flathead System fisheries study: Interim report 1986.** Cross, P.D. (Confederated Salish and Kootenai Tribes, Pablo, MT (USA)). Nov 1986. Contract AI79-83BP39830. 105p. NTIS, PC A06. File Number DE87003085.

From 1 December 1985 through 31 May 1986 the aquatic environment of the Lower Flathead System study area was in deep winter. Winter conditions resulted in limited ability to make field observations through much of the period covered by this interim report. Study activities were directed toward planning the upcoming field season, equipment repair and maintenance, data entry and analysis, winter ice fishing survey, limited pike radio tracking, and annual budget development. Early spring activities included monitoring of rainbow trout (Salmo gairdneri) runs on the Jocko River and Mission Creek. High water and undercutting at the Jocko weir resulted in only 5 fish being captured. Thirty-six rainbow trout were passed through the Mission weir. Both weirs were permanently removed in the month of May prior to spring run-off. In May 1986 low flow measurements (3200 cfs) for the IFIM portion of the study were completed at the Sloans and McDonald sites. A second flow of approximately 10,000 cfs was scheduled for July. Upon completion of all flow measurements, data entry for computer modeling was initiated.

9042 **(FERC/DEIS—0040-S) Supplement to the draft environmental impact statement for the Hamma Hamma Hydroelectric Project, FERC [Federal Energy Regulatory Commission] No. 3178, Washington.** (USDOE Federal Energy Regulatory Commission, Washington, DC. Office of Hydropower Licensing). Nov 1986. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002833.

Public Utility District No. 1 of Mason County, Washington, proposes to construct and operate a hydroelectric project with an installed capacity of 22.34 megawatts located approximately 30 miles north of Shelton, Washington, on the Hamma Hamma River. The FERC issued a draft environmental impact statement in April 1985. This supplement addresses the potential for cumulative impacts in the Hamma Hamma River Basin from multiple hydroelectric development, including sedimentation impacts to salmonid spawning and rearing habitats, disruption of gravel recruitment with attendant impacts to salmonid spawning habitats, impacts to bald eagles from reduced food supply and roosting habitat, and the indirect cumulative impacts that would occur to Native American Tribes if fish runs were reduced. The staff concluded that cumulative impacts would occur in all these issue areas, except to bald eagle roosting habitat, if the three hydroelectric projects were constructed in the same year and operated simultaneously thereafter. Although mitigative measures could reduce the levels of cumulative impact, the cumulative impacts would still be significant because of the importance of the anadromous fisheries resource in the Hood Canal area and in light of the current depressed state of the Hood Canal fishery.

14 SOLAR ENERGY

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 9027, 9036, 9604, 9606, 10008

9043 **(AD-A—172295/8/XAB) Photoluminescent properties of n-GaAs electrodes: simultaneous determination of depletion widths and surface hole-capture velocities in photoelectrochemical cells. Technical report.** Burk, A.A.; Johnson, P.B.; Hobson, W.S.; Ellis, A.B. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 10 Sep 1986. 32p. (UWIS/DC/TR—86/2). NTIS, PC A03/MF A01.

Steady-state photoluminescence measurements performed on n-GaAs electrodes used in photoelectrochemical cells (PEC's) employing a stabilizing, aqueous telluride electrolyte yield values for the electrode's depletion width W and surface hole-capture velocity S. Between -1.0 V (a potential near short circuit) and -1.5 V vs. an SCE reference electrode (a potential near open circuit at the photon flux of 1 x 10^{18} photons/sq cm employed), the interface behaves ideally: virtually all of the applied potential appears in the semiconductor space-charge region. Over this potential regime S is determined to be constant to within 10% and has a value, using literature values for hole lifetime and diffusion length, of approximately 200,000 cm/s for n-GaAs electrodes having carrier concentrations of (1 - 4) x 10^{17}/cu cm. Similar values of S obtained in air and in the PEC suggest a common rate-limiting mechanism for hole consumption in the two media.

9044 **(CONF-8610181—1) Function of active-site lysines of ribulose bisphosphate carboxylase/oxygenase.** Hartman, F.C.; Foote, R.S.; Larimer, F.W.; Lee, E.H.; Machanoff, R.; Milanez, S.; Mitra, S.; Mural, R.J.; Niyogi, S.K.; Soper, T.S. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences). 1986. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87001681.

From Seminar on new aspects of plant cell biology and molecular biology; Kashiko-Jima, Japan (20 Oct 1986).

As one facet of elucidating the mechanism of ribulose-P_2 carboxylase, we have focused on active-site characterization with affinity labels. This report describes the determination of the pK/sub a/ values of two lysine residues thought to be at the active site, based on the pH-dependencies of chemical modification, determination of their proximity based on covalent cross-linking with bifunctional reagents, and determination of the consequences on catalytic functionality of their selective replacement with other amino acids by site-directed mutagenesis. 14 refs., 1 fig.

9045 **(DOE/JPL/954334—T22) Fluid bed silane decomposition R and D: Flat Plate Solar Array project: Final report for Phase 4, July 1982-April 1986.** (Union Carbide Corp., Washougal, WA (USA). Electronic Materials Technical Center). Aug 1986. Contract NAS-7-100-954334. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002680.

The commercial production of low-cost semiconductor-grade silicon is an essential requirement of the Flat-Plate Solar Array (FSA) project. A 1000 metric ton per year commercial facility using the Union Carbide Silane Process was estimated to produce molten silicon for a price of $7.56/Kg (1975 dollars, private financing), meeting the DOE goal of less than $10/Kg. During Phases I and II, the basic technology was demonstrated by laboratory experiments that silane can be produced via a closed-loop chemical process. The objective of Phase III was the establishment of the practicality of a process producing semiconductor-grade silicon by a two-step process, the preparation of silane and the subsequent pyrolysis of silane to yield high-purity silicon. Under Phase IV, a continuation of contract 954334 for the period July 1982 through April 1986, work was performed on Fluid Bed Silane Decomposition by Union Carbide Corporation for the Jet Propulsion Laboratory. This contract had the overall objective of developing the process technology for the production of semiconductor grade polycrystalline silicon in a large commercial plant by 1986, at a price of not more than $14/Kg of silicon based on 1975 dollars. The fluid bed reactor R and D program had the objective of demonstrating process feasibility by conducting long duration test runs and evaluating product samples. The results from the work demonstrated that a unit could be operated under steady-state conditions while achieving virtually complete silane conversion in the bed. The feasibility of growing a dislocation-free, high-resistivity, single crystal from the fluid bed product was shown.

9046 **(N—86-32876) Photovoltaic conversion of laser power to electrical power.** Walker, G.H.; Heinbockel, J.H. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Sep 1986. 18p. (NASA-TM—89041; NAS—1.15:89041). NTIS HC A02/MF A01.

Photovoltaic laser to electric converters are attractive for use with a space-based laser power station. This paper presents the results of modeling studies for a silicon vertical junction converter used with a Nd laser. A computer code was developed for the model and this code was used to conduct a parametric study for a Si vertical junction converter consisting of one p-n junction irradiated with a Nd laser. These calculations predict an efficiency over 50 percent for an optimized converter.

9047 **(ORNL/M—258) Ultrastructural and flow cytometric analyses of lipid accumulation in microalgae: Annual report, Solar Energy Research Institute, Aquatic Species Program.** Solomon, J.A.; Hand, R.E. Jr.; Mann, R.C. (Oak Ridge National Lab., TN (USA)). [1986]. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002879.

Lipid accumulation in three species of microalgae was investigated with flow cytometry (FCM) and transmission electron microscopy (TEM). Previous studies using batch cultures of algae have led to the assumption that lipid accumulation in microalgae is a gradual process requiring at least several days for completion. However, FCM reveals, through changes in the chlorophyll:lipid ratio, that the time span required for individual cells to change metabolic state is short. Simultaneous FCM measurements of chlorophyll and nile red (neutral lipid) fluorescence in individual cells of nitrogen-deficient Isochrysis populations revealed a bimodal population distribution as one stage in the lipid accumulation process. The fact that two discrete populations exist, with few cells in an intermediate stage, suggests rapid response to a lipid trigger. Interpretations of light and electron microscopic observations are consistent with this hypothesis. The time required for an entire population to achieve maximum lipid content is considerably longer than that required for a single cell, due to the variation in response time among cells. In this study high lipid cultures were sometimes obtained by using FCM to separate high lipid cells from the remainder of the population. FCM holds much promise for strain enhancement but considerable developmental work, directed at providing more consistent results, remains to be done. 8 refs., 33 figs.

9048 **(PNL—5943) Analysis and comparison of biomass pyrolysis/gasification condensates: Final report.** Elliott, D.C. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1986. Contract AC06-76RL01830. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003597.

This report provides results of chemical and physical analysis of condensates from eleven biomass gasification and pyrolysis systems. The samples were representative of the various reactor configurations being researched within the Department of Energy, Biomass Thermochemical Conversion program. The condensates included tar phases and aqueous phases. The analyses included gross compositional analysis (elemental analysis, ash, moisture), physical characterization (pour point, viscosity, density, heat of combustion, distillation), specific chemical analysis (gas chromatography/mass spectrometry, infrared spectrophotometry, proton and carbon-13 nuclear magnetic resonance spectrometry) and biological activity (Ames assay and mouse skin tumorigenicity tests). These results are the first step of a longer term program to determine the properties, handling requirements, and utility of the condensates recovered from biomass gasification and pyrolysis. The analytical data demonstrates the wide range of chemical composition of the organics recovered in the condensates and suggests a direct relationship between operating temperature and chemical composition of the condensates. A continuous pathway of thermal degradation of the tar components as a function of temperature is proposed. Variations in the chemical composition of the organic components in the tars are reflected in the physical properties of tars and phase stability in relation to water in the condensate. The biological activity appears to be limited to the tars produced at high temperatures. 56 refs., 25 figs., 21 tabs.

9049 **(SAND—86-2396C) Overview of the DOE terrestrial crystalline solar cell research program.** Gee, J.M.; Arvizu, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 12p. (CONF-8610165—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87000981.

From Space photovoltaic research and technology conference; Cleveland, OH, USA (7 Oct 1986).

There has been significant progress in the crystalline solar cell area in the past two years that has rejuvenated interest in high efficiency devices for terrestrial photovoltaic systems. The most significant developments have been in the crystalline silicon cell area but progress in the III-V area has also been recorded. A review of terrestrial crystalline cell research is presented along with a description of future research directions.

9050 **(SERI/SP—273-2302) The production of herbaceous feedstocks for renewable energy.** (Solar Energy Research Inst., Golden, CO (USA)). Sep 1986. Contract AC02-83CH10093. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85012136.

This document describes the use of a selected group of herbaceous plants as energy feedstocks. Twelve herbaceous crops were selected for study based on their above average yields; their composition, which can increase their value for fuel and other applications; and their ability to produce in a variety of soils and climates. Six of the twelve are carbohydrate crops (sugarcane, sweet sorghum, sweet-stemmed grain sorghum, Jerusalem artichoke, sugar beet, and fodder beet), and six are lignocellulosic crops (kenaf, napiergrass, alfalfa, reed canarygrass, common reed, and water hyacinth). The contribution that herbaceous crops can make to the total US energy supply is discussed. Each candidate crop is characterized in terms of chemical composition, storage, processing, products, and uses. Growth characteristics and production practices in terms of geographic range, yield potential, and cultural requirements are described. Barriers to private sector development of herbaceous energy crops are listed and how R & D programs could be directed to overcome these roadblocks. The areas considered are feedstock selection and production, harvesting and transport, and processing and conversion.

9051 **(SERI/STR—211-3034) Photovoltaic p-n junction cells employing new organic dyes having high stability and designed molecular properties: Final subcontract report.** Bird, G.R.; Panayotatos, P.; Sauers, R.R.; Potenza, J. (Rutgers--the State Univ., New Brunswick, NJ (USA)). Oct 1986. Contract AC02-83CH10093. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87001110.

This report contains the results of work done on more than 30 combinations of organic dye pairs and of organic dye-metal electrode pairs suitable for fabricating p-n heterojunction and test Schottky-barrier solar cells, respectively. More than 350 individual cells and test structures were fabricated by vacuum evaporation of thin (300 A) dye layers on electrodes. Both familiar and newly synthesized organic semiconductors were used. In the two-dye p-n cells, the limitation of partial absorption has been successfully overcome and full visible solar spectrum coverage has been achieved. A set of criteria were devised for the optimization of p-n junction cells that include material and cell design requirements. The best results to date have been obtained with a ClAlPc and DMP pair.

9052 **(SERI/STR—211-3051) Development of monolithic GaAs concentrator and spectral splitter: Annual subcontract report, 1 April 1985-31 March 1986.** Spencer, M.G. (Howard Univ., Washington, DC (USA)). Oct 1986. Contract AC02-83CH10093. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001112.

This report documents research done on gallium arsenide (GaAs) concentrator solar cells. Measurements were made on the optical path of a monolithic spectral splitter cell arrangement. GaAs solar cells were fabricated using molecular beam epitaxy (MBE) technology. The resulting solar cells showed maximum efficiencies of 6 to 8% without an antireflection coating. These cells had low open-circuit voltages and fill factors. Electron-beam-induced current (EBIC) measurements showed that growth defects were not contributing significant loss components, indicating that the effective minority recombination lifetime in the material is low. Further investigations are planned in order to increase the low open-circuit voltage and understand the problem better.

9053 **Photoconductive device containing zinc oxide transparent conductive layer.** Tran, N.T.; Lewis, S.C.; Love, R.B.; Miller, S.C.; Shing, Y.H.; Sibert, J.W.; Tanner, D.P. (to Atlantic Richfield Co., Los Angeles, CA). US Patent 4,623,601. 18 Nov 1986. Filed date 4 Jun 1985. v.p.

This patent describes a photoconductive device comprising a thin film silicon hydrogen alloy (TFS) photoconductor and front and back contacts. The improvement described here comprises at least one of the front and back contacts being a transparent conductive layer consisting essentially of zinc oxide or zinc oxide containing hydrogen or zinc oxide containing a group III element or zinc oxide containing both hydrogen and a group III element. The transparent conductive layer has a resistivity in the range of about 10/sup -4/ to 10/sup -2/ ohm-centimeter.

9054 **Photochemical hole burning and strong electron-phonon coupling: primary donor states of reaction centers of photosynthetic bacteria.** Hayes, J.M.; Small, G.J. (Iowa State Univ., Ames). *Journal of Physical Chemistry;* **90**: No. 21, 4928-4931(9 Oct 1986). Contract W-7405-ENG-82.

A theory for photochemical hole burning valid for arbitrarily strong linear electron-phonon coupling is developed and applied to the P-870 and P-960 states of Rh. sphaeroides and viridis. The mechanism responsible for the unusually large hole widths of these states is established.

9055 **Photothermal energy conversion progress and future perspectives.** Olsen, K.O. (Solar Thermal and Materials Research Div., Solar Energy Research Institute, Golden, CO). pp 275-302 of A 1983 view of non-conventional energy sources. Furlan, G.; Mancini, N.A.; Sayigh, A.A. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8306296—).

From International conference and summer workshop on the physics of non-conventional energy sources; Trieste, Italy (20 Jun 1983).

This paper emphasizes higher temperature applications of solar thermal (photothermal) energy conversion. These technologies have great potential as future significant contributors to the world's needs for industrial process heat, electrical power generation and fuels and chemicals production. Although much progress has been made in research and development for these technologies, there are still significant steps that must be taken to realize their full potential. Typical system descriptions are presented first to highlight basic elements, temperature ranges and operating parameters. Next an assessment of the current state of technology within the U.S. is provided which contains specific examples of major demonstrations. Description of system performance economic variables are provided leading into an evaluation of future research and development needs for the technologies.

1407 Solar Thermal Power Systems

9056 **(SAND—86-8018) A user's manual for DELSOL3: A computer code for calculating the optical performance and optimal system design for solar thermal central receiver plants.** Kistler, B.L. (Sandia National Labs., Livermore, CA (USA)). Nov 1986. Contract AC04-76DR00789. 231p. NTIS, PC E10/MF A01; 1; GPO Dep. File Number DE87003598.

DELSOL3 is a revised and updated version of the DELSOL2 computer program (SAND81-8237) for calculating collector field performance and layout and optimal system design for solar thermal central receiver plants. The code consists of a detailed model of the optical performance, a simpler model of the non-optical performance, an algorithm for field layout, and a searching algorithm to find the best system design based on energy cost. The latter two features are coupled to a cost model of central receiver components and an economic model for calculating energy costs. The code can handle flat, focused and/or canted heliostats, and external cylindrical, multi-aperture cavity, and flat plate receivers. The program optimizes the tower height, receiver size, field layout, heliostat spacings, and tower position at user specified power levels subject to flux limits on the receiver and land constraints for field layout. DELSOL3 maintains the advantages of speed and accuracy which are characteristics of DELSOL2.

9057 **(SAND—86-8249) Review of the Molten Salt Electric Experiment: A solar central receiver project.** Delameter, W.R.; Bergan, N.E. (Sandia National Labs., Livermore, CA (USA)). Dec 1986. Contract AC04-76DR00789. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003592.

The Molten Salt Electric Experiment was the first full solar-to-electric central receiver system to use molten nitrate salt as a primary working fluid. The experiment was built and tested at the Central Receiver Test Facility in Albuquerque, New Mexico, between 1982 and 1985. The purpose of the project was to demonstrate the technical feasibility of a molten salt central receiver system. The Molten Salt Electric Experiment was operated through a year of successful testing; system performance was measured, operating procedures and an effective receiver control algorithm were developed, and personnel from participating electrical utilities and solar industries were trained to operate the system. The testing culminated in a one-month power production campaign to measure daily performance, component reliability, and system availability. This paper discusses the major accomplishments and some of the more significant problems of the project.

9058 **(SERI/TR—252-2663) Technical and economic evaluation of a solid-particle/air direct-contact heat exchanger.** Green, H.J.; Leboeuf, C.M.; Bohn, M.S. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1986. Contract AC02-83CH10093. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87001113.

A conceptual design of a solid-particle/air heat exchanger system is presented including a multistage fluidized-bed heat exchanger, solid-particle feeders and defeeders, and cyclones. The system is designed for 100°C solid particles that heat air at 10 atm at a 100-MW heat rate. This type of heat exchanger could be part of a solar thermal central receiver system that uses solid particles as the heat transfer media. The technical and economic feasibilities of this system are evaluated. As an alternative to direct contact, a shell-and-tube heat exchanger is evaluated as well. The direct-contact system is technically feasible though additional development is needed in some areas. The annual levelized cost per unit of delivered thermal energy for a direct-contact system based on state-of-the-art technology is estimated to be $6.66/GJ. If reasonable assumptions are made as to technical progress resulting from future development activities, the cost drops to $2.30/GJ. The cost of a shell-and-tube heat exchanger for the same service is estimated to be $2.91/GJ.

1408 Ocean Energy Systems

9059 **Composite turbine blade design options for Claude (open) cycle OTEC power systems.** Penney, T.R. (Solar Energy Research Institute, Golden, CO). pp 606-611 of Proceedings of the fifth international offshore mechanics and Arctic engineering (OMAE) symposium. Volume 2. Chung, J.S.; Yoshida, K.; Ellinas, C.P.; Huang, T.; Rhee, H.C.; Penney, T. New York, NY; American Society of Mechanical Engineers (1986). (CONF-860443—).

From Offshore mechanics and arctic engineering symposium; Tokyo, Japan (13 Apr 1986).

Small-scale turbine rotors made from composites offer several technical advantages for a Claude (open) cycle ocean thermal energy conversion (OTEC) power system. Westinghouse Electric Corporation has designed a composite turbine rotor/disk using state-of-the-art analysis methods for large-scale (100-MW/sub e/) open cycle OTEC applications. Near-term demonstrations using conventional low-pressure turbine blade shapes with composite material would achieve feasibility and modern credibility of the open cycle OTEC power system. Application of composite blades for low-pressure turbo-machinery potentially improves the reliability of conventional metal blades affected by stress corrosion.

9060 **Effect of flow velocity on the corrosion of some aluminum alloys in deep ocean seawater.** Jain, S.; Larsen-Basse, J. (Dept. of Mechanical Engineering, Univ. of Hawaii at Manoa, Honolulu, HI 96822). pp 1-7 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Tube samples of aluminum alloys 5052, alclad (7072) 3003 and 3004 were exposed for one and four months in Pacific seawater pumped from 600 m depth at the Natural Energy Laboratory of Hawaii, at flow velocities which varied between 0.25 and 2.1 m/s (0.85 and 7 fps). Alloy 5052 showed uniform corrosion at a low rate, though minor localized attack may have been incipient for the lowest velocity sample. The alclad samples showed localized attack which did not penetrate into the base metal and which gave a minimum in weight loss at an intermediate rate of flow, falling in the range 0.5-1.0 m/s. Above that value there was a negligible increase in weight loss with velocity; below that value the attack increased very rapidly with lower flow rates because areas of base metal became exposed and contributed growth in cathodic area. The attack was more pronounced on the lower one half of the diameter of the horizontally mounted samples. The roll-form-welded alclad 3004 samples showed the greatest attack with 80% of the cladding lost after 4 months at the lowest flow velocity. The high rate of attack was associated with initial corrosion of a cold worked strip of cladding produced by a hold-down roll during welding and with subsequent accelerated corrosion around the cathodic weld region. The results indicate that careful design must be done and that alloy development and testing probably must take place before aluminum alloys can confidently be used for OTEC condenser heat exchangers or for other applications involving cold ocean water from depth.

1409 Solar Thermal Utilization

9061 **(DOE/SF/12221—T7) Laboratory evaluation of the solar incinerability of hazardous organic wastes: Technical progress report no. 8, June 1, 1985-June 30, 1985.** (Hawaii Univ., Honolulu (USA)). 1985. Contract AC03-84SF12221. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003189.

During the period of June 1, 1985 to June 30, 1985, work on this project proceeded into the data taking portion of the Phase II effort. Specifically, both the effectiveness purely thermal decomposition and the combined thermal/photolytic decomposition of 1,2,4-trichlorobenzene was determined. To actually begin this phase of the project several details had to be completed. These included culmination of the solar simulator, writing software for data acquisition and reduction, and developing the methodology for using the TPRS.

9062 **(EUR—9911) Provincial domain of Chevetogne. Outdoor swimming pool solar heating system: demonstration project.** Van Gysel, M. (Commission of the European Communities, Luxembourg). 1985. 84p. (In French and English). Commission of the European Communities, Luxembourg.

A solar heating system has heated the Olympic-size outdoor swimming pool of the domain of Chevetogne (Province de Namur, Belgium) since 1981. 2108 m² of single glazed, selective surface, copper absorber, solar collectors provide some 700 MWh per year in a season from April to September. A larger yield would result from using the heat generated in winter to heat nearby buildings. The system has been operated satisfactorily for three years until now. A grant of some BFR 11 million has been allotted in the framework of the demonstration programme 'Solar heated swimming pools', carried out by the Commission of the European Communities. An extensive measurement campaign has allowed detailed appreciation of the operation.

9063 **(NP—7900252) Performance data sources: Task 8, Passive and hybrid solar low energy buildings.** Morck, O.; Holtz, M.J. (Danmarks Tekniske Hoejskole, Lyngby; Architectural Energy Corp., Westminster, CO (USA)). Jan 1986. 270p. NTIS (US Sales Only), PC A12/MF A01. File Number DE87900252.

This document presents the results of a survey of monitored passive and hybrid solar low energy residential buildings conducted within IEA countries during the period from autumn 1983 to spring 1985. The survey was undertaken as part of Subtask A, Performance Measurement and Analysis, of Task VIII, Passive and Hybrid Solar Low Energy Buildings of the IEA Solar Heating and Cooling Programme. One of the objectives of this Subtask is to report on the availability of data from monitored passive and hybrid solar low energy residential buildings in the member countries. The intent is to identify sources of high quality performance data for purposes of simulation and design tool evaluation, passive and hybrid system performance characterization and policy formulation. The major part of the report consists of building description forms which briefly describe the buildings, summarize performance, list available data and identify reference sources for further information. More detailed performance data is provided for 60 of the buildings. To assist the reader in findings projects of particular interest, an indexing system has been generated, using 16 different entries from the forms.

9064 **Solar collector assembly and kit.** Matzkanin, R.L. (to Alternative Energy Resources, El Paso, TX). US Patent 4,622,951. 18 Nov 1986. Filed date 28 May 1985. v.p.

A method is described of installing a solar collector water heater comprising the steps of: assembling a main frame over a base board by sliding corner keys into ends of a pair of side rails and a pair of end rails. The base board has mounted thereon a solar absorber plate including a heat exchanger at one end of the absorber plate with couplings for connection to a tank; installing a water tank onto the frame, the tank having a make-up water inlet, a heated-water outlet, a tank-to-heat-exchanger coupling and a heat-exchanger-to-tank coupling; connecting the make-up water inlet to a source of water, the heated water outlet to an inlet of a hot water system, and the tank-to-heat-exchanger coupling and the heat-exchanger-to-tank coupling to the associated couplings of the heat exchanger; assembling onto the main frame at least one glazing panel formed of a panel frame and a sheet of transparent material stretched onto the panel frame, the latter including rail members secured to one another, at least some of the rail members having integral snap-fit structure thereon cooperating with mating structure formed integrally on at least some of the rails of the main frame. The assembling includes sliding at least one rail member of the panel frame onto a corresponding rail of the main frame so that the snap-fit and mating structures interengage one another to hold the glazing panel securely in place over the absorber plate.

9065 **Transient response of latent heat storage in greenhouse solar system.** Huang, B.K.; Toksoy, M.; Cengel, Y.A. (North Carolina State Univ., Raleigh). *Solar Energy;* **37:** No. 4, 279-292(1986).

A latent heat storage system with two different stacking configurations and air bafflings was designed and constructed as an integrated part of the greenhouse solar system (solar barn). Commercial cylindrical storage rods were used as the primary storage elements. The results showed that the designed latent storage systems demonstrated significantly higher compact storage capacity than water or rock storage and that the ring-baffled storage unit performed better than the cross-baffled storage unit.

1410 Solar Collectors And Concentrators

9066 **(CERIB-PT—80) Solar application of concrete roofing tiles.** Aufredou, C.; Dran, F.; Chambrin, G. (Centre d'Etudes et de Recherches de l'Industrie du Beton Manufacture (CERIB), 28 - Epernon (France)). Jan 1986. 31p. (In French). NTIS (US Sales Only), PC A03. File Number DE87750415.

The purpose of this study is to evaluate the advantages of collecting solar energy by concrete roofing tiles, and to determine to what extent the collected energy can be recovered. The study of different types of tiles shows that the tile's shade is the most influential parameter: the darker colours give the best yield. In the best case, the yield - with respect to the incident energy - reaches 20%. This value has been confirmed, for a Δt of 10°C, by performance measurements in a specialized lab, on a roof portion equipped with an air-water absorber exchanger.

9067 (DOE/SF/12202—1) Thin-film material research for low-cost solar collectors: Final report for the period March 1984-November 1986. Duffy, D.R.; Muller, T.K.; Hull, J.L. (Acurex Corp., Mountain View, CA (USA). Environmental Systems Div.). Dec 1986. Contract AC03-84SF12202. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87002798.

This report describes research on thin-film polymer materials for solar collectors. A thorough materials search and screening was performed of off-the-shelf polymer materials for use in the absorber and glazing of low-temperature, flat-plate collectors. A testing series was conducted on the most promising material candidates. Of the absorber material candidates, only the fluorocarbons successfully passed the tests. However, due to their high cost, they exceed the cost goals established. Efforts at "engineering" a material to fit the application were encouraging. The best material was a phenolic resin modified by addition of phenoxy and epoxy to make it more flexible. Evaluations were performed to compare pressurized versus trickle-type collector designs. The trickle-type design was selected. Subscale absorber sections were fabricated and tested to verify the trickle-type absorber concept. A large size field study was conducted to assess field layout and system flow control requirements of a trickle-type collector in comparison to a rigid metal, flat-plate collector. Somewhat larger piping sizes are required for good flow distribution, but cost reduction gains from the low-cost, thin-film absorber are still significant.

9068 (EUR—9309) Focusing solar collector with deformable mirror in the temperature range 100-200°C. Bougard, J.; Bouidida, M. (Commission of the European Communities, Luxembourg). 1984. 411p. (In French). Commission of the European Communities, Luxembourg.

This work concerns a focusing collector for the medium temperature range, 100-200°C, in which the focalisation of sun's rays is obtained by changing the shape of the mirror, maintaining the fixed orientation of the casing. For every incidence angle, from -22 to 22°, the mirror (a 0.6 mm silvered glass sheet), is deformed between two fixed points to achieve focalisation. It has been shown theoretically and experimentally that the ideal shape (a parabola) is obtained easily by pushing or pulling on the mirror in only two chosen points. Many tests on an optical bench have confirmed the possibility of obtaining local concentration ratios from 6 to 20, in very good accordance with predicted values. Using complex analytical and computer calculations, a parametric analysis has been performed. A full-scale prototype has been built and tested under indoor conditions using a solar simulator, and under outdoor conditions using a specially designed medium temperature thermal loop. The values of the optical and thermal parameters are satisfactory, showing a reduced stagnation temperature of 0.38 under normal incidence and a concentration factor larger than 6 for every incidence angle.

9069 (NP—7770037) Increasing the energy absorption of a mineral compound of the system calcium aluminate silicate-quartz-graphite from air enthalpy and solar radiation by optimising the thermal conductivity. Geist, M. (Hamburg Univ. (Germany, F.R.). Fachbereich 13 - Chemie). 28 Jun 1983. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87770037.

Apart from irradiated energy, an energy roof also uses the enthalpy of the surrounding air by acting as a heat exchanger. Expensive corroding, heavy metal plates having adaptation problems were previously used for such energy roofs. However, a compound based on concrete with embedded components having high thermal conductivity has advantages over this. In order to optimise the thermal conductivity of a mineral compound, the conductivity, mechanical strength and water penetration resistance of the three stage system calcium aluminate silicate (Portland cement), quartz and graphite were measured. The method of measurement of the thermal conductivity, the results of testing compressive and bending strength, the water penetration, resistance in space, density, sealing and adhesive material, armouring of the compound, sieving lines and optimisation of the composition of the compound material are explained. In the subsequent practical part, data are given on the design of energy test roofs and their energy balance, as well as on the energy absorption by convection and radiation and the energy emission. There are data on materials and heat transfer in the appendix. (HWJ).

9070 Successive lumped analysis simulation of solar energy collection systems. Newell, T.A.; Althof, J.A. (Illinois Univ., Urbana, USA. Dept. of Mechanical and Industrial Engineering; Solar Energy Research Inst., Golden, CO, USA). *International Journal of Energy Research;* **10**: No. 3, 277-290(Jul-Sep 1986).

A methodology for deriving an analytical, simplified solar system performance prediction model is presented. Factors related to system design can be examined; for example, storage tank temperature variations, solar system turn-on and turn-off times and system 'memory'. A simple domestic water heating type system is used as a basis for illustrating derivation of performance models. Predicted performance results are in good agreement with results obtained from another design method. A generalized procedure is described for deriving new system models. The lumped analysis simulation may prove useful for non-standard applications where other simplified design methods are not defined and where detailed simulation capability is not available.

1420 Heat Storage

9071 Chemical storage of solar energy - the Flood-Foerland-Lindemann hypotheses and the decomposition of pyrosulfate ions. Prengle, H.W. Jr.; Lee, M.C. (Univ. of Houston, TX). *Solar Energy;* **37**: No. 4, 293-299(1986). Contract AC03-81SF11557.

The endothermic decomposition of metal pyrosulfate in molten phase to produce metal sulfate and sulfur trioxide gas is an important chemical energy storage reaction. A chemical reaction engineering analysis of certain literature data was carried out to obtain a model for the decomposition and the rate constant as a function of temperature. The analysis indicates that the rate controlling reaction event is the cation-anion interaction of K^+ and $S_2O_7^{-2}$ ions to form $KS_2O_7^{-1}$, simultaneously polarizing the latter to weaken the S-O-S bridge and release SO_3. Based on this view transition state theory was applied and yielded an expression for the rate constant in essential agreement with experimental data. A preliminary model for a pilot-scale reactor is presented.

9072 Chemical storage of solar energy - kinetics of heterogeneous NH_3 and H_2SO_4 reaction. I. Analysis of experimental reaction and mass transfer data. Lee, M.C.; Prengle, H.W. Jr. (Univ. of Houston, TX). *Solar Energy;* **37**: No. 4, 301-311(1986). Contract AC03-81SF11557.

The exothermic heterogeneous reaction of ammonia vapor and liquid sulfuric acid ($H_2O + SO_3$) to produce ammonium hydrogen sulfate and ammonium sulfate is important for the recovery of stored energy in the small molecules, H_2O, SO_3 and NH_3. As the first part of a chemical reaction engineering analysis, literature data on the reaction and mass transfer were analyzed. The reaction rate constant as a function of temperature and the mass transfer coefficient as a function of the dynamical variables in a flow system were determined. The reaction mechanism in concentrated liquid phase is pseudo-second order and the rate is extremely fast. However, for the heterogeneous system with ammonia transferred from the vapor phase the mass transfer is rate controlling. A broad range of mass transfer data, covering packed columns and dispersed phase droplets, was correlated over 15 orders of magnitude by the j/sub D/-factor correlation method.

15 GEOTHERMAL ENERGY

1502 Geology And Hydrology Of Geothermal Systems

9073 **(DOE/SF/11721—T1) Heat-flow mapping at the Geysers Geothermal Field.** Thomas, R.P. (California Dept. of Conservation, Sacramento (USA). Div. of Oil and Gas). 1986. Contract AC03-83SF11721. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002779.

Pertinent data were compiled for 187 temperature-gradient holes in the vicinity of The Geysers Geothermal field. Terrain-correction techniques were applied to most of the temperature-gradient data, and a temperature-gradient map was constructed. Cutting samples from 16, deep, production wells were analyzed for thermal conductivity. From these samples, the mean thermal conductivities were determined for serpentinized ultramafic rock, greenstone, and graywacke. Then, a heat flow map was made. The temperature-gradient and heat-flow maps show that The Geysers Geothermal field is part of a very large, northwesterly-trending, thermal anomaly; the commercially productive portion of the field may be 100 km^2 in area. The rate that heat energy flows through the surface by thermal conduction is estimated at 1.79 x 10^{9}MJ per year. The net heat energy loss from commercial production for 1983 is estimated at 180.14 x 10^{9}MJ.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 8893

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 8871

9074 **(DOE/ID/12578—T1) Geopressurized/geothermal project, Pleasant Bayou well no. 2, Brazoria County, Texas: Workover summary, February 15, 1986-April 3, 1986.** (Eaton Operating Co., Inc., Houston, TX (USA)). 1986. Contract AC07-85ID12578. 60p. NTIS, PC A04. File Number DE87002597.

A workover of the Pleasant Bayou well No. 2 to clear debris from the well and replace leaking 5.5" production tubing is described. (ACR)

17 WIND ENERGY

1706 Wind Energy Engineering

9075 **(DOE/BP/11191—4) Cape Blanco wind farm feasibility study: Technical report No. 4, Electrical engineering.** (Portland General Electric Co., OR (USA)). Sep 1986. Contract AC79-83BP11191. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002663.

The purpose of this report is to present preliminary design information on the electrical engineering aspects for the Cape Blanco Wind Farm Feasibility Study. Since the wind turbine generators themselves are presumed to be already designed, this report includes the basic equipment requirements, cost estimates, general system studies, construction timetables, and drawings for the balance of the electrical plant and tieline interconnection. Also included is a discussion of the design philosophy employed in making these studies. The original plans for the possible development of an 80-MW wind farm at Cape Blanco involved investigating the feasibility of five different wind-turbine machine layouts. Ultimately, only two machine types were selected for study: the FloWind (170-kW vertical axis) and the MOD-2 (2.5-MW horizontal axis) wind-turbine machines. The selection of these two wind-turbine machine layouts provided for a comparison of smaller units (FloWind) to that of larger units (MOD-2) for an equivalent-sized wind farm system.

9076 **(DOE/NASA—0247-3) WEST-3 wind turbine simulator development: Volume 3, Software.** Hoffman, J.A.; Sridhar, S. (Paragon Pacific, Inc., Torrance, CA (USA)). Jul 1985. Contract AI01-76ET20320. 228p. (NASA-CR—174983; PPI-FID—300086). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE87002841.

This report deals with the software developed for WEST-3, a new, all digital, and fully programmable wind turbine simulator developed by Paragon Pacific Inc. The process of wind turbine simulation on WEST-3 is described in detail. The major steps are, the processing of the mathematical models, the preparation of the constant data, and the use of system software to generate executable code for running on WEST-3. The mechanics of reformulation, normalization, and scaling of the mathematical models is discussed in detail, in particular, the significance of reformulation which leads to accurate simulations. Descriptions for the preprocessor computer programs which are used to prepare the constant data needed in the simulation are given. These programs, in addition to scaling and normalizing all the constants, relieve the user from having to generate a large number of constants used in the simulation. Also given in the report are brief descriptions of the components of the WEST-3 system software: Translator, Assembler, Linker, and Loader. Also included in the report are: details of the aeroelastic rotor analysis, which is the center piece of a wind turbine simulation model; analysis of the gimbal subsystem; and listings of the variables, constants, and equations used in the simulation.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

9077 **(EPRI-AP—4681) Technology assessments of advanced power generation systems 2: Kalina bottoming cycle: Final report.** (Mechanical Technology, Inc., Latham, NY (USA)). Nov 1986. 66p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920100.

A preliminary assessment of the Kalina cycle as the bottoming system of a small, combined-cycle power plant found that the cost of electricity for this plant was calculated to be somewhat less than that of competing steam-bottoming systems. This new system requires further analysis, however, particularly of the trade-off between heat exchanger cost and cycle performance.

9078 **(EPRI-CS—4859) Gas-cleaning technology for high-temperature, high-pressure gas streams: 1984 annual report: Interim report.** Ciliberti, D.F.; Lippert, T.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). Oct 1986. 86p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920102.

This report presents the results of work completed in 1984 under EPRI Contract RP 1336-1 on the evaluation and development of hot gas cleanup technology for pressurized, fluidized-bed combustion (PFBC). Reported are results of tests on both the SiC candle and woven ceramic bag filters. Tests were conducted under simulated PFBC conditions using redispersed ash in an existing subscale facility with single filter elements. A filter baghouse facility for long-term materials durability testing is also described.

9079 **(NP—7750812) Optimization of heat extraction from power plants taking into account the time-dependent fluctuation of power and heat demand and making use of accumulators. Final report.** Beer, J.; Rukes, B.; Windorfer, E. (Kraftwerk Union A.G., Erlangen (Germany, F.R.); Wibera Wirtschaftsberatung A.G., Duesseldorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1985. 189p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87750812.

The objective of this study is to equip a hard-coal-fired intermediate-load unit to be newly constructed such that the heat demand required can be covered as economically as possible without modifying the power generation schedule specified. It is to be demonstrated, in particular, how the procurement of replacement process heat can be influenced by using heat accumulators in the event of power plant outages or standstills during the weekend.

The technical and economic data were stipulated for the units to be analyzed alternatively with 200, 400 and 800 MW electric power, from which units a varying thermal output (100 to 500 MJ/s) is to be extracted. These data can be used to study the effect of different power plant equipment by means of a computer code prepared specifically for this purpose. In this context, the load requirements of the power plant in terms of district heating and power can be processed on an hour-to-hour basis. In most cases, an increase in steam generator capacity in conjunction with a heat accumulator proved to be the most favourable power plant equipment. The optimum accumulator is only 1/10 to 1/2 as large as the weekend accumulator designed for maximum heat demand. The specific heat generation cost ex works amounts to 28,00 to 37,00 DM/MWh without and 21,00 to 32,00 DM/MWh with subsidy in accordance with the '3. Verstromungsgesetz' (Third Electricity from Coal Act). With 35 refs., 18 tabs., 99 figs.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 8806, 8852, 10006

9080 (EPRI-CS—4833) Availability analysis for flue gas desulfurization improvement decisions: Final report. Smith, M.J. (Pickard, Lowe and Garrick, Inc., Newport Beach, CA (USA)). Oct 1986. 152p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920106.

This report presents the results of a study to determine the usefulness of availability analysis techniques, such as EPRI's UNIRAM methodology, for guiding decisions involving improvements for flue gas desulfurization (FGD) systems. The demonstration of these techniques was conducted using the FGD system at Philadelphia Electric Company's Cromby 1 coal-fired power plant. The results showed that availability analyses can provide significant insight for decisions faced by plant personnel responsible for FGD improvements. These decisions can involve choices that impact the design, operations, or maintenance of the FGD system and can be directed toward various levels of the system hierarchy, from the overall FGD system to individual components. In addition, the results indicate that these availability analyses could provide additional value to plant personnel if they are combined with performance analyses; i.e., analyses of process variables and their impact on equipment availability. This combination of analyses would permit these personnel to define actions for controlling the process variables to enhance FGD system availability. 2 refs., 6 figs., 6 tabs.

9081 (EPRI-EA—4907) Application of the Ecosystem Assessment Model to Lake Norman: A cooling lake in North Carolina: Final report. Porcella, D.B.; Bowie, G.L.; Campbell, C.L. (Tetra Tech, Inc., Lafayette, CA (USA)). Nov 1986. 165p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920117.

The Ecosystem Assessment Model (EAM) of the Cooling Lake Assessment Methodology was applied to the extensive ecological field data collected at Lake Norman, North Carolina by Duke Power Company to evaluate its capability to simulate lake ecosystems and the ecological effects of steam electric power plants. The EAM provided simulations over a five-year verification period that behaved as expected based on a one-year calibration. Major state variables of interest to utilities and regulatory agencies are: temperature, dissolved oxygen, and fish community variables. In qualitative terms, temperature simulation was very accurate, dissolved oxygen simulation was accurate, and fish prediction was reasonably accurate. The need for more accurate fisheries data collected at monthly intervals and non-destructive sampling techniques was identified.

2003 Power Transmission And Distribution

9082 (DOE/ET/29046—T1) 1200 kV semi-flexible gas-insulated transmission program, February 1984. Volume two. Final report appendices. Dale, S.J. (Westinghouse Electric Corp., Trafford, PA (USA). Power Equipment Div.). Feb 1984. Contract AC01-78ET29046. 430p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE86008525.

Techniques of thermal analysis and determination of the current rating of the isolated phase compressed gas insulated transmission line (CGIT) systems, used in Power Circuit Breaker Division of Westinghouse Electric Corporation, have been documented. We first compute ac resistances and power losses at estimated temperatures for the conductor and the enclosure, convective and radiative heat transfer coefficients between conductor and sheath, and those between enclosure and ambient. Then the thermal networks are set up, depending on whether the system is placed in air, buried, or placed in a tunnel. These are solved for conductor and enclosure temperatures. Computed temperatures are compared with the initially estimated ones. Computation is repeated, if necessary, until a satisfactory convergence is attained.

9083 (DOE/ET/29046—T2) 1200 kV semi-flexible gas-insulated transmission program, February 1984. Volume one. Final report. Dale, S.J. (Westinghouse Electric Corp., Trafford, PA (USA). Power Equipment Div.). Feb 1984. Contract AC01-78ET29046. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86008524.

An SF_6 insulated semi-flexible transmission line is described which uses a corrugated aluminum enclosure to reduce cost and provide flexibility. Mechanical behavior was evaluated using finite element computer analysis, bending, hydrostatic, thermal, vacuum and fatigue tests. A 711 mm (28 in.) internal diameter, 4 mm (0.16 in.) wall, 3004 aluminum enclosure with 19 mm (0.75 in.) deep corrugations at a pitch of 70 mm (2.75 in.) was shown adequate for internal and external pressure. A field installation centerline bending radius of 15 m (50 ft) was demonstrated. Dielectric characteristics of the compact 1200 kV design with SF_6 at 440 kPa (50 psig) was established through detailed field plotting and scale model tests. High voltage tests on 550 kV and 1200 kV prototypes verified that a design using a smooth conductor with discrete flexible elements met the performance criteria established. The electrical and mechanical parameters of the 1200 kV and a 550 kV design are reported. These meet the performance and cost objectives.

9084 (PNL—5955) Customer System Efficiency Improvement Assessment: Description and examination of system characterization data. Callaway, J.W.; DeSteese, J.G. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003593.

This report describes three data bases that were developed in the Customer System Efficiency Improvement (CSEI) Assessment project to help characterize transmission and distribution (T and D) system losses experienced by utility customers in the Pacific Northwest. A principal objective of this project is to assess the potential for electric energy conservation in the T and D systems of BPA's utility customers. The three data bases provide essential input on the number and operating characteristics of T and D component stocks that was used in another task of the CSEI Project to estimate the conservation supply functions that result from replacing existing stocks with more efficient components (Tepel et al. 1986). This document describes the three data bases, provides a guide to their use, and presents a summary characterization of the principal loss-generating components (lines and transformers) of the region's T and D systems.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 10672, 10673

9085 (DPSP—84-1-1-Del.Ver.) [Savannah River Plant]: Technical report. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Jan 1984. Contract AC09-76SR00001. 106p. NTIS, PC A06. File Number DE87003116.

Activities and safety performance are reported in the areas of equipment engineering, health protection, laboratories, and environment control and energy conservation. In the area of equipment engineering, equipment development and inspection, failure analysis, and process surveillance are discussed for the reactor, separations, raw materials, waste management, and power areas. In the area of health protection, radiation survey is discussed for the reactor, separations, and waste management areas. Also covered are occupational health engineering and dosimetry environmental monitoring. With regard to laboratories, activities are reported in heavy water and materials control, production support, and methods development. (LEW)

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 9103, 9104, 9123, 9138, 9160, 9162, 9163, 9164, 9167, 9168, 9169, 9172, 9173, 9175, 9177, 9178, 9179, 9181, 9188, 9190, 9194, 9200, 9202, 9203, 9209, 9212, 9213, 9249

9086 **(AIF/NESP—038) Constraints on boiling water reactor piping system inspection, mitigation, repair and replacement.** Doubleday, E.C.; Cowfer, C.D.; Murphy, B.F.; Dodd, F.J. (Nuclear Energy Services, Inc., Danbury, CT (USA)). Sep 1986. 174p. Atomic Industrial Forum, Inc., 7101 Wisconsin Ave., Bethesda, MD 20814-4891. File Number TI87900250.

Since the discovery of Intergranular Stess Corrosion Cracking (IGSCC) in large diameter 304 stainless steel piping in the reactor recirculation system at Unit 1 of Niagara Mohawk Power Corporation's Nine Mile Point Station in the spring of 1982, the detection, mitigation and repair of IGSCC type cracking has been a major focus of the US BWR industry. IGSCC has already caused the extended shutdown of six plants to replace piping systems with new, crack resistant material. US BWR owners have spent tens of millions of dollars conducting extensive inspection and reinspection programs, in the development and application of mitigation methods and the implementation of repair procedures. As a result of the high cost of unplanned and extended outrage time and the widespread nature of the problem, the body of papers, studies, procedures and data related to the IGSCC issue has grown rapidly. In addition, the approached utilized at individual utilities have varied widely based on the specific circumstances in existence at the time the IGSCC inspection, mitigation, repair or replacement program had to be implemented. This report is intended as a "snapshot" view of current industry technology and experience. It is based on information obtained through a series of interviews with key utility personnel involved in the IGSCC issue at all operating BWR plants and certain plants under construction. The information gathered in this manner has been combined with a comprehensive literature review. The major areas of the IGSCC issue are addressed: inspection, mitigation, repair and replacement.

9087 **(EPRI-NP—4926) Review of records requirements related to LWR life extension: Final report.** Metcalf, D. (Grove Engineering, Gaithersburg, MD (USA)). Nov 1986. 183p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920131.

Current regulatory requirements for inspection and recording of inspection and operating data are reviewed from the perspective of plant life extension. The approach taken was hierarchical, using Title 10, Code of Federal Regulations, Part 50 (10 CFR 50), as a starting point. These requirements led to subsidiary requirements in the Appendices to 10 CFR 50, license applications, Regulatory Guides, Technical Specifications, and industry codes and standards. A comprehensive listing of the various requirements that relate to life extension is developed, with the conclusion that a substantial amount of test and inspection data already required is of potential benefit. Data and records requirements are most complete for systems important to safety, with much less emphasis on the secondary side of the plant. The most comprehensive source of relevant performance and material condition information is the Inservice Inspection (ISI) program. The surveillance requirements of Technical Specifications also require broad data collection. A third source of data, which can be of use in establishing baseline conditions or initial system performance, is records from the quality assurance program for design and construction, preoperational testing, pre-service inspection, and the initial test program.

9088 **(JAERI-M—84-245) Evaluation of a Jet Pump Model for RELAP5 code.** Suzuki, Mitsuhiro; Kumamaru, Hiroshige; Tasaka, Kanji; Okazaki, Motoaki; Matsuo, Takashi; Okada, Akira. (Japan Atomic Energy Research Inst., Tokyo; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1985. 160p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number DE87700282.

The report presents the results of revision and evaluation of the JAERI Jet Pump Model which has been developed for RELAP5 code. Analyses for the ROSA-III experiments were performed by the RELAP5 code with the Jet Pump Model. The model can solve not only the single phase steady water flows but also the transient flows through the ROSA-III jet pumps. The JAERI Jet Pump Model can predict the jet pump characteristics more accurately than the small pump model used for convenience to drive the suction flow. And therefore, the JAERI Jet Pump Model is useful to calculate accurately the mass inventory in each region and heat transfer in core. The model for the BWR jet pump analyses, however, needs appropriate geometrical data which represent the complicated suction flow paths around the 5 holes drive nozzle.

9089 **(NUREG—1204) Technical specifications: Perry Nuclear Power Plant, unit no. 1 (Docket no. 50-440): Appendix "A" to license no. NPF-58.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1986. 468p. NTIS, PC A20/MF A01 - GPO. File Number TI87900298.

This report presents technical specifications for the Perry-1 Reactor in the areas of: safety limits and limiting safety system settings; limiting conditions for operation and surveillance requirements; design features; and administrative controls. (JDB)

9090 **(NUREG/CR—4764) Energy Economic Data Base (EEDB) Program, Phase 8 update (1986) report. BWR supplement.** (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Oct 1986. Contract AC05-84OR21400. 262p. (ORNL/Sub—86-86004/7). NTIS, PC A12/MF A01 - GPO. File Number TI87002285.

This report contains detailed cost estimates for reference boiling-water reactor (BWR) power plants with Mark II and Mark III containments. The cost estimates are based on typical utility industry experience for light-water reactor plants and environmental and safety regulations in effect as of January 1986. The study identifies direct equipment, materials, structures, and labor costs and indirect costs in sufficient detail to be used as a baseline for estimating the costs of future modifications. This information is needed to satisfy the Nuclear Regulatory Commission's (NRC) cost estimating needs for Regulatory Impact Analysis for new requirements.

9091 **(STUK-B-YTO—27) Safety-related incidents at the Finnish nuclear power plants. Quarterly report: 3. and 4. quarter 1985.** Lehtinen, P. (comp.). (Finnish Centre for Radiation and Nuclear Safety, Helsinki. Dept. of Nuclear Safety). Mar 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750413.

This report contains detailed descriptions of operating incidents and other safety-related matters at the Finnish nuclear power plants regarded as significant by the regulatory authority, the Finnish Centre for Radiation and Nuclear Safety. In this connection, an account is given of the practical actions caused by the incidents, and their significance to reactor safety is evaluated. The main features of the incidents are also described in the general Quartely Reports, Operation of Finnish Nuclear Power Plants, which are supplemented by this report intended for experts.

9092 **Wide range flux monitor assembly.** Glesius, F.L.; Kroon, J.C.; Schneider, D.A.; Myrabo, A. (to Reuter-Stokes, Inc., Twinsburg, OH). US Patent 4,623,508. 18 Nov 1986. Filed date 15 Feb 1984. v.p.

This patent describes an in-core wide range flux monitor assembly for boiling water reactors having a monitor range of 10/sup -8/% to 100% full power comprising: at least one source and intermediate range fission detector to detect neutron flux at least within the range of 10/sup -8/% to 10% of full power and to produce a source and intermediate range output signal representative thereof. The detector has an ion chamber and an insulating oversheath for insulating the ion chamber from reactor vessel potential. The oversheath is exposed to reactor ground potential and electrically isolated from instrument ground potential, an insulation ring being disposed adjacent the oversheath terminate end portion; at least one power range fission detector to detect neutron flux at least within the range of 1% to 100% of full power and to produce a power range output signal representative thereof. The power range fission detector includes an insulating oversheath; and, means for processing the output signals whereby neutron flux may be monitored over a wide range of reactor power.

9093 **Evaluation of type 182 weld metal cracks at the Pilgrim Nuclear Power Station.** Czajkowski, C.J. (Dept. of Nuclear Energy, Brookhaven National Lab., Upton, NY 11973). pp 1-9 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

A boat sample from the Alloy 182 weld "butter" area of a 28 inch diameter recirculation outlet nozzle from the Pilgrim Unit #1 Nuclear Power Station was subjected to a metallurgical failure analysis. The analysis consisted of metallography and scanning electron microscopy/energy dispersive spectrographic examination. The fracture surfaces were intercrystalline in appearance with the fractures occurring along the dendritic grains of the weld metal. The cracking is considered to be an intercrystalline stress corrosion cracking phenomenon of susceptible Alloy 182 weld metal in a boiling water reactor environment.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 8961, 9087, 9091, 9123, 9127, 9137, 9167, 9168, 9169, 9171, 9172, 9173, 9174, 9175, 9176, 9177, 9178, 9180, 9181, 9185, 9188, 9190, 9191, 9192, 9193, 9194, 9195, 9196, 9198, 9199, 9201, 9202, 9203, 9205, 9209, 9211, 9212, 9213, 9214, 9249, 9681

9094 **(CEA-CONF—8376) Operating experience of main steam isolation valves at Fessenheim and Bugey.** Dredemis, G.; Fourest, B.; Giroux, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1985. 9p. (CONF-850713—13; CEA-DAS—180). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750261.

From International conference on nuclear power plant aging, availability factor and reliability analysis; San Diego, CA, USA (7 Jul 1985).

The paper presents the experience of Hopkinson MSIVs over about 40 reactor-years (1977 to 1984) of operation at Fessenheim and Bugey units (900 MWe PWR). The various problems encountered including ageing effects on auxiliary equipments and increases in closure time are discussed. The corrective actions undertaken by the utility and the safety assessment of these events performed by the French safety authorities are also described. This study is the synthesis of an in-depth analysis of Main Steam Isolation Valves (MSIV) and their auxiliary circuits equipping the Bugey and Fessenheim 900 MWe PWR nuclear power plants. These valves are different from those installed in the other French 900 MWe PWR reactors. The evaluation of the operation of these valves was made on the basis of incidents which occurred during operation of the units or during the periodic tests, as well as anomalies discovered during maintenance operations. This analysis proved that the anomalies related to the design of the valves, as well as to their manufacture and installation, had been correctly dealt with. Furthermore, it should have also revealed potential anomalies due to ageing of the equipment.

9095 **(DOE/ET/34013—12) The nondestructive examination of fuel assemblies with standard and advanced design rods after three cycles of irradiation.** Smith, G.P. (Combustion Engineering, Inc., Windsor, CT (USA). Power Systems Div.; Arkansas Power and Light Co., Little Rock (USA)). Nov 1986. Contract AC02-79ET34013. 125p. (CEND—426). NTIS (US Sales Only), PC A06/MF A01; 1; GPO Dep. File Number DE87003624.

The objective of this program, which is sponsored by the US Department of Energy, is to extend the burnup capability for Combustion Engineering 16 x 16 fuel. This program is in progress at the Arkansas Nuclear One, Unit 2 (ANO-2) reactor located near Russellville, Arkansas which is a 2815 MWt pressurized water reactor (PWR) owned and operated by Arkansas Power and Light Co. It is the first reactor supplied by Combustion Engineering to utilize the 16 x 16 fuel design. The extended burnup objective of this program will be realized by showing that the current fuel design is capable of increasing batch average exposure at discharge to 55 GWd/mtU and by evaluating advanced fuel designs with the potential to offer increased performance margins over the current design at similar discharge exposures. Analyses are included to assure that the extended burnup objective can be realized with conventional and low-leakage fuel management schemes. This report covers the poolside examinations performed at ANO-2 after Reactor Cycle 4. These examinations collected fuel performance data on two Batch D assemblies (DO39 and DO40) after three cycles of irradiation. The assembly average and lead-rod burnups for these assemblies at end-of-cycle 4 (EOC-4) are 32.9 and 38.7 GWd/mtU, respectively. Assembly DO39 was discharged at EOC-4 and was examined in detail, including disassembly and single-rod inspections. Assembly DO40 was visually examined and dimensional measurements were performed. DO40 was returned to the core for continued irradiation in Reactor Cycle 5.

9096 **(DOE/ET/34212—50) The hot cell examination of Oconee 1 fuel rods after five cycles of irradiation.** Newman, L.W. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Oct 1986. Contract AC02-78ET34212. 175p. (BAW—1874). NTIS (US Sales Only), PC A08/MF A01; 1; GPO Dep. File Number DE87002850.

Babcock and Wilcox Mark B (15x15) fuel rods were examined in the hot cell after three, four, and five cycles of irradiation in the Oconee Unit 1 pressurized water reactor. The burnups of these rod groups were 31,940, 39,180, and 49,570 MWd/mtU, respectively. Nondestructive and destructive examinations were performed to gather fuel performance data, and to assess the impact of high burnup on key fuel and fuel rod characteristics. This effort is part of a Department of Energy program to improve uranium utilization and decrease the number of spent fuel assemblies discharged annually by extending the burnup of light water reactor fuel. Of the fuel and fuel rod cladding phenomena investigated, fuel-cladding mechanical interaction, cladding waterside oxidation oxidation and hydrogen absorption, cladding mechanical properties, and fission gas release were identified as being the more significanct concerns for implementing extended burnup. Of these phenomena, cladding waterside corrosion at burnups greater than 55,000 MWd/mtU remains the one with no immediate design solution. Advanced cladding designs are being developed, but require irradiation exposure and subsequent investigation to mitigate this concern.

9097 **(EPRI-NP—4898) Evaluation of PWR tubesheet crevice-flushing approaches: Final report.** Sawochka, S.G.; McNea, D.A.; Clouse, M.E.; Kassen, W.R. (NWT Corp., San Jose, CA (USA)). Nov 1986. 116p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920140.

Processes for removing impurities from tube-to-tubesheet crevices of PWR steam generators were evaluated employing a rectangular flat plate simulant of the crevice region. Either sodium chloride or sodium hydroxide solutions were used to prepare the crevice fill media with magnetite powder used to simulate the crevice corrosion product. The effectiveness of the tested impurity removal processes is discussed in light of the physical/chemical basis of each process. Heatup/cooldown cycling and low temperature depressurization both appear to offer promise relative to improving the efficiency of normally employed crevice flushing efforts at commercial units.

9098 (GEND—057) **TMI-2 [Three Mile Island] fission product inventory program: FY-85 status report.** Langer, S.; Croney, S.T.; Akers, D.W.; Russell, M.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1986. Contract AC07-76ID01570. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003639.

This report presents the status of the TMI-2 fission product inventory program through May 1985. The fission product inventory program is an assessment of the location of fission products distributed in the plant as a result of the TMI-2 accident. Included in this report are principal results of samples from the reactor building where most of the mobile fission products (i.e., radiocesium and iodine) are expected to be found. The data are now complete enough for most reactor components; therefore, it is possible to direct the balance of the examination and sampling program to areas and components where it is likely to be most productive. Those areas are the reactor core and the reactor building basement, with emphasis on the currently unsampled portions of the core.

9099 (IHZ-WIK—85-533/601/2, pp 24-27) **Most important research activities of the Institute of Electric Energy in Budapest (VEIKI) in the field of nuclear engineering in the years 1981-1984.** Voeroess, L. (Institut fuer Elektroenergie, Budapest, Hungary). 1985. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780051. (CONF-8504237—Pt.2).

From 7. scientific conference on power industry of the Ingenieurhochschule Zittau; Zittau, German D.R. (16 Apr 1985).

The most important research activities of the Institute of Electric Energy in Budapest (VEIKI) are presented in the field of nuclear engineering in the years from 1981 to 1984. The integral leak testing of the containment, and a complex heat engineering test of nuclear power plant units are mentioned as two examples of the problems in relation to reactor commissioning and reactor start-up. During reactor operation noise diagnostics studies are carried out. Mechanical strength calculation methods have been developed by means of finite element methods. The main problem in relation to safety engineering is the development of computer codes for the simulation of transient states at occurring at reactor operation failures and reactor accidents. Therefore safety and reliability analyses as well as risk assessments are carried out. A research program has been established for the development of modern control techniques of water treatment in the primary coolant circuit.

9100 (INIS-mf—10519, pp 31) **Sup(110m)Ag in primary circuit coolant of WWER-440 type nuclear power plant.** Burclova, J.; Bena, J.; Pokorny, V.; Barta, O. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice, Czechoslovakia; Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9101 (NUCLEBRAS-CDTN—487) **Design study of a PWR of 1.300 MWe of Angra-2 type operating in the thorium cycle.** Andrade, E.P.; Carneiro, F.A.N.; Schlosser, G.J. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil); NUCLEBRAS, Belo Horizonte (Brazil); Kraftwerk Union A.G., Erlangen (Germany, F.R.)). 5 Dec 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700463.

The utilization of the thorium-highly enriched uranium and thorium-plutonium mixed oxide fuels in an unmodified PWR is analysed. The PWR of 1300 MWe from KWU (Angra-2 type) is taken as the reference reactor for the study. Reactor core design calculations for both types of fuels considering once-through and recycle fuels. The calculations were performed with the KWU design codes FASER-3 and MEDIUM 2.2 after introduction of the thorium chain and some addition of nuclide data in FASER-3. A two-energy group scheme and a two-dimensional (XY) representation of the reactor core were utilized.

9102 (NUCLEBRAS-CDTN—523) **Installation for rewetting experiments.** Rezende, H.C.; Ladeira, L.C.D. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). Mar 1986. 48p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700464.

A test facility for rewetting experiments (ITR), has been erected at the Thermalhydraulics Laboratory of Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), with the objective of performing investigation of basic phenomena that occur during the reflood phase of a Loss of Coolant Accident (LOCA), in a Pressurized Water Reactor (PWR), utilizing tubular and annular test sections. The mechanical aspects of the facility, its power supply system and its instrumentation are described. The results of the calibration of the instruments and the description of two typical testes performed to verify the operational conditions are presented. A comparison with calculations using a computer code is also presented.

9103 (STUK-B-YTO—28) **Operation of Finnish nuclear power plants. Quarterly report, 4. quarter 1985 and annual summary.** Lehtinen, P. (comp.). (Finnish Centre for Radiation and Nuclear Safety, Helsinki. Dept. of Nuclear Safety). May 1986. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750411.

Same report published in Finnish as STUK-B-YTO-26.

These general reviews of the operation of the Finnish nuclear power plants concentrate on such events and discoveries related to reactor and radiation safety that the regulatory body, the Finnish Centre for Radiation and Nuclear Safety, regards as noteworthy. The report also includes a summary of the radiation safety of the personnel and the environment and tabulated data on the production and load factors of the plants. No event in the report period, or in the whole year 1985, degraded plant safety in any essential way nor posed a radiation hazard to the personnel or the environment.

9104 (STUK-B-YTO—30) **Operation of Finnish nuclear power plants. Quarterly report, 1. quarter 1986.** Lehtinen, P. (comp.). (Finnish Centre for Radiation and Nuclear Safety, Helsinki. Dept. of Nuclear Safety). Aug 1986. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750412.

Same report published in Finnish as STUK-B-YTO-29.

These general reviews of the operation of the Finnish nuclear power plants concentrate on such events and discoveries related to reactor and radiation safety that the regulatory body, the Finnish Centre for Radiation and Nuclear Safety, regards as noteworthy. The report also includes a summary of the radiation safety of the personnel and the environment, as well as tabulated data on the production and load factors of the plants. In the report period, no event essentially degraded plant safety nor posed a radiation hazard to the personnel or the environment.

9105 **Metallurgical evaluation of failed post-tensioned containment tendon anchors at Joseph M. Farley Unit 2.** Czajkowski, C.J. (Dept. of Nuclear Energy, Brookhaven National Lab., Upton, NY 11973). pp 1-14 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

A metallurgical examination has been performed on three failed post-tensioned containment tendon anchors and one intact anchor from the Farley Unit 2 Nuclear Power Station. The evaluation consisted of chemical/mechanical testing, optical microscopy, scanning electron microscopy, and energy dispersive spectroscopy. The conclusions drawn from the investigation were: 1) the anchors met the chemical and mechanical properties of AISI 4140/4142 steel; 2) there was no evidence of phosphorous segregation to the grain boundary (by ethereal picral etch); 3) the observed cracking was generally a mixed mode of intergranular and quasi-cleavage as well as ductile rupture with the intergranular cracking occurring along prior austenite grain boundaries; 4) the results of the mechanical tests coupled with the discontinuous nature of the intergranular areas and the elimination of other modes of failure give sufficient indication that the failure was a hydrogen induced cracking phenomenon.

9106 Combining integral and differential dosimetry data in an unfolding procedure with application to the Arkansas nuclear one-unit 1 reactor. Maerker, R.; Broadhead, B.; Fu, C.Y.; Wagschal, J.; Williams, J.; Williams, M. (Oak Ridge National Lab., Oak Ridge, TN). pp 477-481 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The LEPRICON adjustment procedure involves combining both differential and integral data, including covariances and sensitivities, in such a way that calculated spectral fluences at important locations within a pressure vessel of an operating PWR can be adjusted with significantly reduced uncertainties. The procedure allows simultaneous combination of integral dosimetry measurements performed at a reactor surveillance location with measurements performed in geometrically simpler benchmark facilities. An application of this technique is given to an existing PWR, and the results consistently indicate a need for significant ($\approx$ 8%) adjustments in the total inelastic cross section of iron in the region between 3 and 8 MeV using cross sections and covariances from ENDF/B-V. Dosimetry cross sections were taken mainly from a revised version of ENDF/B-V and were found to require relatively small adjustments. Covariances of the spectral fluences are reduced by factors lying between two and four.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 9161, 9184, 9187, 9206, 9948

9107 (CEA-SERMA—29-T) Experimental programme on high temperature reactors in CESAR and MARIUS. Balance and outlooks. Laponche, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Jan 1972. 46p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750713.

This report reviews the different stages of the development of the nuclear measurement program carried out in MARIUS and CESAR on lattices of high temperature reactors with a slightly-enriched uranium fuel cycle. The international framework in which the program takes place is recalled. Taking into account the French interest evolution in this reactor type to the study of Fort Saint Vrain type reactors, a program is proposed for the years 1973-1974. The MARIUS and CESAR reactors have been modified to carry out the experimental studies on reactors using moderately enriched uranium and graphite moderated. The study of coated fuel particles as base of fuel elements required new equipments. Several experiments of a new type have been planned (PCTR, fuel sphere stack study), as also the utilization of new calculation methods (codes WIMS and APOLLO). 16 refs.

9108 (JAERI-M—84-242) Analysis code of three dimensional core dynamics for the experimental multi-purpose very high temperature reactor. COMIC-60 (version 1). Takano, Makoto; Takikawa, Yoshio. (Japan Atomic Energy Research Inst., Tokyo; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1985. 105p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700310.

The code has been developed for core dynamics analysis of the experimental multi-purpose very high temperature reactor. Utilizing 60 degrees rotational symmetry, the code models the 1/6 part of core in three dimension. Space-time dependent diffusion equation is integrated in time to solve neutronic dynamics of the core. Temperature effect is taken into consideration by solving coolant channel models distributed over the core. The control rods can be adjusted by built-in control systems so that reactor power and coolant temperature at reactor outlet are kept constant.

9109 A compact reactor/ORC power source. Meier, K.L.; Kirchner, W.L.; Willcutt, G.J. (Los Alamos National Lab., Reactor Design and Analysis Group (Q-12), Los Alamos, NM 87545). pp 1388-1393 of Proceedings of the 21st intersociety energy conversion engineering conference. Washington, DC; American Chemical Society (1986). (CONF-860810—).

From Intersociety energy conversion engineering conference; San Diego, CA, USA (25 Aug 1986).

A compact power source that combines an organic Rankine cycle (ORC) electric generator with a nuclear reactor heat source is being designed and fabricated. Incorporating existing ORC technology with proven reactor technology, the compact reactor/ORC power source offers high reliability while minimizing the need for componenet development. Thermal power at 125 kWt is removed from the coated particle fueled, graphite moderated reactor by heat pipes operating at 500°C. Outside the reactor vessel and connected to the heat pipes are vaporizers in which the toluene ORC working fluid is heated to 370°C. In the turbine-alternator-pump (TAP) combined-rotating unit, the thermal energy of the toluene is converted to 25 kWe of electric power. Lumped parameter systems analyses combined with a finite element thermal analyses combined with a finite element thermal analysis have aided in the power source design. The analysis have provided assurance of reliable multiyear normal operation as well as full power operation with upset conditions, such as failed heat pipes and inoperative ORC vaporizers. Because of inherent high reliability, long life, and insensitivity to upset conditions, this power source is especially suited for use in remote, inaccessible locations where fuel delivery and maintenance costs are high.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 9166

9110 (AECL—8774) CANDU reactor experience: fuel performance. Truant, P.T.; Hastings, I.J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Ontario Hydro, Toronto (Canada)). Jul 1985. 10p. (CONF-850609—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700283.

From 25. annual international conference of the Canadian Nuclear Association and 6. annual conference of the Canadian Nuclear Society; Ottawa, Ontario, Canada (2 Jun 1985).

Ontario Hydro has more than 126 reactor-years experience in operating CANDU reactors. Fuel performance has been excellent with 47,000 channel fuelling operations successfully completed and 99.9 percent of the more than 380,000 bundles irradiated operating as designed. Fuel performance limits and fuel defects have had a negligible effect on station safety, reliability, the environment and cost. The actual incapability charged to fuel is less than 0.1 percent over the stations' lifetimes, and more recently has been zero.

9111 (AECL—8850) Examination of the ruptured Zircaloy-2 pressure tube from Pickering NGS Unit 2. Transcript of video presentation. Cheadle, B.A.; Smith, A.D.; Baskin, C.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700284.

On 1983 August 01 a Zircaloy-2 pressure tube in Pickering NGS Unit 2 ruptured. All the fuel channel components, the fuel bundles, pressure tube, end fittings, garter springs and calandria tubes were shipped to Chalk River Nuclear Laboratories for examination to determine the cause of the rupture. The examination showed that the rupture initiated at a series of hydride blisters on the outside surface of the pressure tube. The blisters formed because of the garter spring spacers between the pressure tube and calandria tube was about one metre out of position. This allowed the horizontal pressure tube to sag by creep and touch the cool calandria tube. The resulting thermal gradients in the pressure tube concentrated the hydrogen and deuterium at the cool zones and blisters of solid hydride formed. Cracks initiated at several of the blisters and linked together to form a partial through wall critical crack which initiated the final rupture. The video presentation shows how the examination of the fuel channel components was conducted in underwater bays and shielded cells and explains the sequence of events that caused the rupture.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 9186, 9207, 9667

9112 (CEA-CONF—8452) **First Superphenix fuel load reliability analysis and validation.** Marbach, G.; Beche, M.; Pajot, J. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Sep 1986. 12p. (CONF-860931—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750273.

From International conference on reliable fuels for liquid metal reactors; Tucson, AZ, USA (7 Sep 1986).

The excellent behavior of PHENIX driver fuel and the burnup values currently reached suggest that the first SUPERPHENIX fuel load will meet the design lifetime. However, to ensure the reliability of the entire load, all the parameters affecting fuel behavior in reactor must be analyzed. For that purpose, we have taken into account all the results of the examination and verifications during the fabrication process of the first load subassemblies. These data concern geometrical parameters or oxide composition as well as the cladding tube and plug weld soundness tests. The objective is to determine the actual dispersion of all the parameters to ensure the absence of failure due to fabrication defects with very high statistical confidence limits. The influence of all the parameters has been investigated for the situations which can occur during power-up, steady-state operation and transients. The fabrication quality allows us to demonstrate that in all cases good behavior criteria for fuel and structure will be maintained. This demonstration is based on calculation code results as well as on validation by specific experiments.

9113 (CTA-IEAV-RP—025/85) **Small liquid metal reactor for an initial phase of fast breeder reactor introduction.** Ishiguro, Y.; Nascimento, J.A. do. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 7 Nov 1985. 30p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700466.

Safety and burnup characteristics of a 1000 MWth liquid metal reactor have been examined for various fuel types. With metallic Pu/Th fuel containing a small amount of zirconium hydride, low sodium-void reactivity, a high Doppler coefficient, and small burnup reactivity swings can be achieved. A conservative design is considered for an initial phase of fast breeder reactor development and possible modifications are discussed.

9114 (ENEA-RT-TIB—86/7) **ARMA modeling and Bootstrap technique for accuracy evaluation of parameters of interest in nuclear reactor field.** Marseguerra, M.; Porceddu, C.M.; Sola, P.G. (Politecnico di Milano (Italy). Ist. di Ingegneria Nucleare; ENEA, Bologna (Italy). Dipartimento Tecnologie Intersettoriali di Base; Societa NIER, Bologna (Italy)). Mar 1986. 15p. (CONF-8504220—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900285.

From 18. informal noise meeting; Prague, Czechoslovakia (10 Apr 1985).

In Nuclear Reactor Engineering field, ARMA modeling of recorded signals has come into wide use and represents a well established technique for estimating parameters of interest. In lack of information about the probability distribution of the recorded data, the parameter's accuracy may be evaluated by the recently proposed Bootstrap method, suitably worked out, when only a single short record of data is available. The present paper deals with such a procedure, working on the white residuals of the recorded series. The method is checked at first against non-normality by operating on simulated series with exponential white noise. The procedure is then applied to thermocouple experimental data measured in a sodium cooled subassembly mock-up of a fast reactor. The aim is to evaluate the accuracy of the skewness coefficient, whose potential as indicator of modification in the radial temperature profile has been recognized.

9115 (INIS-mf—10512, pp 53) **Dynamical analysis of long-term fuel cycles (nuclear fission)** . Lesch, K.-H.; Heindler, M. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9116 (UJV—7240-T) **Two-dimensional calculation by finite element method of velocity field and temperature field development in fast reactor fuel assembly.** Schmid, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Aug 1985. 25p. (In Czech). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700280.

Computer programs are described, divided into two groups. One includes programs for calculations of laminar flow, of the distribution of tangential stress along the rods and on the walls of the assembly, of flow rate, wet cross section, and flow cross section for the individual cells of the given configuration, and a program for velocity field plotting. The other group includes a program for the calculation of the temperature field development and a program for temperature field plotting. The programs written in GIER-ALGOL are in two versions, viz., for a straight-line triangular element and for an isoparametric triangular element.

9117 (UJV—7242-T) **Two-dimensional calculation by finite element method of velocity field and temperature field development in fast reactor fuel assembly. II.** Schmid, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Nov 1985. 27p. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700285.

For Part I see Report UJV–7240 (Aug 1985).

A package of updated computer codes for velocity and temperature field calculations for a fast reactor fuel subassembly (or its part) by the finite element method is described. Isoparametric triangular elements of the second degree are used.

9118 **Fracture toughness AISI 316 tensile-toughness correlation.** Hamilton, M.L.; Garner, F.A.; Yang, W.J.S. (Hanford Engineering Development Lab., P.O. Box 1970, Richland, WA). *Fusion Technology;* **10**: No. 3, 405-410(Nov 1986). Contract AC06-76FF02170.

Since the microstructural origins of radiation-induced toughness degradation are presumed to be identical to those that cause changes in tensile properties, it appears possible to make predictions of residual fracture toughness based on changes in the tensile behaviour and the associated microstructural evolution of the steel. A model for tensile-toughness correlations is presented that appears to be valid for radiation-hardened stainless steels. Tensile data from both ducts and cladding tubes of 20% cold-worked American Iron and Steel Institute Type 316 stainless steel irradiated in Experimental Breeder Reactor-II are used to make the prediction that sufficient toughness is retained in this steel for both fast reactor and fusion reactor applications.

9119 (CE-Trans—8205) **High temperature strain measurement using the new interatom capacitive transducer.** Fortmann, M. Translated from *VDI-(Verein Deutscher Ingenieure) Berichte ;* No. 514, vp(1984). 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900301.

The combination of theoretical calculation and experimental strain analysis is of particular importance for the operation of plants with high operating temperatures because of their complex stress conditions with at the same time inelastic material behavior. This applies in particular to situations where the actual fraction of service life used must be established by on-line measurements for reasons of safety and economy. To develop the test suitable methods INTERATOM are carrying out creep fatigue tests on original SNR pipe bends under conditions which are as close to reality as possible. A part task comprises quasi-steady-state strain measurement at temperatures of up to 650°C. After careful investigation and supplementary tests the capacitive method was chosen as the method available at present. As the available capacitive strain transducers (CERL-Planer and Boeing) do not satisfactorily meet the measuring requirements specified, we developed our own transducer version. The trial test results of the first production series are contained in this paper.

9120 **(CE-Trans—8206) Deformation measurements on pipework components up to 650°C for service life monitoring.** Fortmann, M. Translated from *VDI-(Verein Deutscher Ingenieure) Berichte ;* No. 480, vp(1983). 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900300.

Thermal material strain is causing restraint stresses and, as a result, considerable structural stresses in pipework systems with high operating temperatures. In this case deformation is taken up by the bends which bend relatively easily compared to the straight piping. The design requirements specified for the fast sodium cooled reactor (SNR-300) have the effect that the temperature-strain controlled stresses are not the most important load parameter. Original SNR-300 pipe bends are tested in an experiment close to reality to demonstrate the operating efficiency of the main coolant pipework and to verify the design. Using a newly developed global strain measuring device for monitoring the service life, it is possible to establish the residual life of a pipe bend. This knowledge should improve plant safety and offer advantages with regard to costs. Apart from the usual operating parameters, internal pressure, temperature and time, relevant for the full use of the service life of a pipe bend the deformations imposed on the pipe bend by restraint of the adjacent pipework are of decisive importance. These data can be verified by local strain measurements until failure of the test pipe bend in conjunction with inelastic calculations.

2107 Regulation And Licensing

9121 **(EGG-M—13886) A preliminary evaluation of the US Nuclear Regulatory Commission's standard review plan with regard to relicensing.** Jacobs, P.T. (EG and G Idaho, Inc., Idaho Falls (USA)). 24 Oct 1986. Contract AC07-76ID01570. 4p. (CONF-861007—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002610.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

A preliminary evaluation of the US Nuclear Regulatory Commission's (NRC) Standard Review Plan (SRP) was conducted with the goal of identifying areas that might need revision if the SRP is used for relicensing/license renewal. The SRP is presently used to guide NRC staff reviewers in assessing safety analysis reports submitted by applicants for construction permits and operating licenses for nuclear power plants. The paper summarizes the findings and recommendations based on the evaluation.

9122 **(INIS-XN—22) Ordinance of 30 September 1985 on fees in the nuclear field.** (International Atomic Energy Agency, Vienna (Austria)). 30 Sep 1985. 3p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700297.

This Ordinance which came into force on 1 October 1985 specifically defines the activities subject to fees and fixes the criteria for calculating the scale. There are two types of fees, those levied by the Federal Energy Office which concern the various licences delivered in accordance with nuclear legislation, and also those levied for conducting prior studies to determine whether and on what conditions a licence could be granted.

9123 **(NUREG/CR—4469-Vol.3) Nondestructive examination (NDE) reliability for inservice inspection of light water reactors: Semi-annual report, April 1985-September 1985.** Doctor, S.R.; Bates, D.J.; Bickford, R.L.; Charlot, L.A.; Deffenbaugh, J.D.; Good, M.S.; Heasler, P.G.; Mart, G.A.; Simonen, F.A.; Spanner, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 59p. (PNL—5711-Vol.3). NTIS, PC A04/MF A01 - GPO. File Number TI87002467.

The Evaluation and Improvement of NDE Reliability for Inservice Inspection of Light Water Reactors (NDE Reliability) Program at the Pacific Northwest Laboratory was established by the Nuclear Regulatory Commission to determine the reliability of current inservice inspection (ISI) techniques and to develop recommendations that will ensure a suitably high inspection reliability. The objectives of this program include determining the reliability of ISI performed on the primary systems of commercial light-water reactors (LWRs), using probabilistic fracture mechanics analysis to determine the impact of NDE unreliability on system safety, and evaluating reliability improvements that can be achieved with improved and advanced technology. A final objective is to formulate recommended revisions to ASME Code and Regulatory requirements, based on material properties, service conditions, and NDE uncertainties. The program scope is limited to ISI of the primary systems including the piping, vessel, and other inspected components. This progress report covers the programmatic work from April 1985 through September 1985.

2108 Economics

REFER ALSO TO CITATION(S) 9090, 9115

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 10682

9124 **(KURRI-TR—268) Report of the development of advanced technology for scientific research.** Shibata, Toshikazu (ed.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1985. 68p. (In Japanese). (CONF-8408209—). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780040.

From Development of advanced technology for scientific research conference; Kumatori, Osaka, Japan (7 Aug 1984).

Individual abstracts were prepared for the papers contained in this report.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 9106, 9139, 9143, 9206, 10296, 10334, 10396, 10407, 10408, 10409, 10410, 10422, 10633

9125 (PPA-BEN—3, pp 8-25) **Characteristics of irradiation facilities at RTP for NAA activity.** Zarina Masood; Gui Ah Auu; Nahrul Khair Rashid; Mohd Amin Sharifuldin Salleh. (Unit Tenaga Nuklear, Bangi, Selangor, Malaysia). 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

At Unit Tenaga Nuklear (UTN), the PUSPATI TRIGA REACTOR (RTP), a 1MW research reactor provides the neutron source required by Neutron Activation Analysis (NAA) activity. Two of its irradiation facilities: the Rotary Specimen Rack (RSR) and the Pneumatic Transfer System (PTS), are mainly used for this purpose. The thermal neutron flux at these facilities at 500kW are 1.59E12 n/cm/sec and 4.92E12 n/cm/sec respectively. As the PTS is located inside the core, the neutron flux are higher. However, the RSR is capable of accommodating 79 samples for irradiation at a time as compared to only 1 for the PTS. Among the first uses of RTP is the irradiation of NAA samples. During 1983, 60% of the reactor operating time was utilised for this purpose and by March 1984, it has increased to 75%. The facilities are mainly used by our own Neutron Activation Analysis group where most of the requests from other institutions are entertained. This paper presents briefly the characteristic of the irradiation facilities, their usage so far, and the problems faced in optimising their utilization.

9126 **Nuclear data needs for fusion reactors.** Gohar, Y. (Fusion Power Program, Argonne National Lab., Argonne, IL 60439). pp 15-44 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The nuclear design of fusion reactor components (e.g., first wall, blanket, shield, magnet, limiter, divertor, etc.) requires an accurate prediction of the radiation field, the radiation damage parameters, and the activation analysis. The fusion nucleonics for these tasks are reviewed with special attention to point out nuclear data needs and deficiencies which effect the design process. The main areas included in this review are tritium breeding analyses, nuclear heating calculations, radiation damage in reactor components, shield designs, and results of uncertainty analyses as applied to fusion reactor studies. Design choices and reactor parameters that impact the neutronics performance of the blanket are discussed with emphasis on the tritium breeding ratio. Nuclear data required for kerma factors, shielding analysis, and radiation damage are discussed. Improvements in the evaluated data libraries are described to overcome the existing problems.

9127 **Application of detailed fission-product decay gamma spectra in the calculation of photoneutron spectra from D(γ,n) reactions in PWR fuel.** Wilson, W.B.; Stewart, J.E.; England, T.R.; Perry, R.T. (Los Alamos National Lab., Los Alamos, NM). pp 545-548 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The magnitude, average neutron energy, and spectrum of the photoneutron source in a PWR fuel is calculated for shutdown times to 100 y using CINDER radionuclide inventory calculations, ENDF/B-V γ line decay spectra, MCNP γ transport calculations, and PHONEX D(γ, n) reaction physics calculations.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 9197, 9366, 9377, 9409, 10667

9128 (EGG-M—20986) **Pipe damping studies.** Ware, A.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 19p. (CONF-8610135—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002602.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Idaho National Engineering Laboratory (INEL) is conducting a research program to assist the United States Nuclear Regulatory Commission (USNRC) in determining best-estimate damping values for use in the dynamic analysis of nuclear power plant piping systems. This paper describes four tasks in the program that were undertaken in FY-86. In the first task, tests were conducted on a 5-in. INEL laboratory piping system and data were analyzed from a 6-in. laboratory system at the ANCO Engineers facility to investigate the parameters influencing damping in the seismic frequency range. Further tests were conducted on 3- and 5-in. INEL laboratory piping systems as the second task to determine damping values representative of vibrations in the 33 to 100 Hz range, typical of hydrodynamic transients. In the third task a statistical evaluation of the available damping data was conduted to determine probability distributions suitable for use in probabilistic risk assessments (PRAs), and the final task evaluated damping data at high strain levels.

9129 **(EPRI-NP—4775) Development of cobalt-free hard-facing alloys for nuclear applications: 1985 progress: Interim report.** Wada, T.; Whelan, E.P. (AMAX Materials Research Center, Ann Arbor, MI (USA)). Oct 1986. 86p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920134.

Cobalt-free hardfacing alloys are needed to replace cobalt-base Alloy No. 6, used in nuclear valves, in order to reduce the exposure of service personnel to radioactivity due to ^{60}Co. A series of iron-base, cobalt-free alloys were prepared and applied as hardfacing overlays on austenitic steel substrates using both GTA and PTA welding processes. Hardness, mechanical properties, and galling wear resistance were determined on welded overlays as well as on cast alloys. Some of the iron-base alloys exhibited galling wear resistance as high as that of Alloy No. 6 both in the cast condition and in the PTA overlays. Other cobalt-free alloys, including long-range ordered (LRO) alloys, have been tested for galling wear resistance and compared to the iron-base alloys. Galling tests were also performed on the laser-remelted hardfacing deposits for evaluating the application of laser treatment to hardfacings on nuclear components.

9130 **(EPRI-NP—4897) Investigation of advanced acoustic and optical nondestructive evaluation techniques: Final report.** Hildebrand, B.P. (Sigma Research, Inc., Redmond, WA (USA). Seattle Div.). Oct 1986. 100p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920135.

Research Project RP606-7 was initiated in 1980 to explore advanced acoustic and optical techniques for nondestructive evaluation of nuclear components. The program was intended to be open ended, in that new tasks could be added and old ones dropped as work progressed. The initial task was to evaluate optical sandwich holography as a means to characterize components before and after service use. The fringe patterns would than be compared to determine if any changes had occurred during service. This work was completed successfully. The second task was to determine how the ultrasonic tomography research, carried out under RP504-1, could be improved upon so that its potential for residual stress measurement could be fulfilled. Several of the road-blocks to this fulfillment, pointed out in NP-1234-SR were overcome in theory, but not put to the experimental test. The third and major task was to develop acoustical holography to the point of commercialization. Although EPRI had given considerable support to the development of acoustical holography, little attention had been paid to the engineering of a versatile, portable system. This deficiency has been corrected during the course of this program. A commercial system, the SDL-1000, is now available to potential users. The first production unit has been delivered to the EPRI NDE Center where it is being evaluated.

9131 (INIS-mf—10514, pp vp) **Cesium extraction from reactor pool water using supported liquid membranes.** Craig, W.M.; Hofman, D.L.; Buchalter, E.M.; Birkill, R.S.; Smit, J.J. (Nuclear Development Corp. of South Africa, Pty. Ltd., Pelindaba, Pretoria; Potchefstroom Univ. for C.H.E., South Africa). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9132 **(NUREG/CR—4614) VISA-II sensitivity study of code calculations: Input and analytical model parameters.** Simonen, E.P.; Johnson, K.I.; Simonen, F.A.; Liebetrau, A.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 49p. (PNL—5863). NTIS, PC AO3-MF A01 - GPO. File Number TI87002716.

The Vessel Integrity Simulation Analysis (VISA-II) code was developed to allow calculations of the failure probability of a reactor pressure vessel subject to defined pressure/temperature transients. A version of the code, revised by Pacific Northwest Laboratory for the US Nuclear Regulatory Commission, was used to evaluate the sensitivities of calculated through-wall flaw probability to material, flaw and calculational assumptions. Probabilities were more sensitive to flaw assumptions than to material or calculational assumptions. Alternative flaw assumptions changed the probabilities by one to two orders of magnitude, whereas alternative material assumptions typically changed the probabilities by a factor of two or less. Flaw shape, flaw through-wall position and flaw inspection were sensitivities examined. Material property sensitivities included the assumed distributions in copper content and fracture toughness. Methods of modeling flaw propagation that were evaluated included arrest/reinitiation toughness correlations, multiple toughness values along the length of a flaw, flaw jump distance for each computer simulation and added error in estimating irradiated properties caused by the trend curve correlation error.

9133 **Push-pull exhaust ventilation system for nuclear component storage and refueling canals.** Porembski, T.P. (to Westinghouse Electric Corp., Pittsburgh, PA). US Patent 4,623,511. 18 Nov 1986. Filed date 26 Apr 1984. v.p.

This patent describes a ventilation system for nuclear installations having a water filled canal for storage or transport of radioactive components under water comprising: a plurality of air nozzles positioned above the surface of the water and directed across the surface; a manifold conduit connected to the nozzles and to air feed means; at least one collecting hood having a plurality of openings therein positioned above the surface and spaced from the nozzles; the openings in the hood substantially facing the canal; means to feed air under pressure to the nozzles to produce a blast of air through the nozzles across the canal surface; means to exhaust air through the hood openings to collect air above the surface and at least part of the air from the nozzles; an exhaust duct connected to the hood openings and to the air exhaust means; and the nozzles and the hood openings being positioned along opposite sides of the canal, the nozzles being substantially horizontally aligned, and the openings being substantially horizontally aligned.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 9116, 9127, 9141, 9159

2204 Control Systems

REFER ALSO TO CITATION(S) 9179

9134 (FRNC-TH—2355) **Theoretical and experimental study of collectrons for epithermal neutron flux in reactors.** Agu, M.N. (Grenoble-1 Univ., 38 (France)). Jan 1986. 204p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE87750749.

A theoretical study of nuclear reactions and electric charge displacements arising in sensitivity to thermal and epithermal neutrons in collectrons allowed a computer code conception. Collectrons in Rhodium, Silver, Cobalt, Hafnium, Erbium, Gadolinium and Holmium have been tested in different radiation fields given by neutron or gamma filters irradiated in different places of Melusine and Siloe reactors. Some emitters were covered with different steel, nickel or zircaloy thicknesses. Theoretical and experimental results are consistent; that validate the computer code and show possibilities and necessity of covering collectron emitters to reduce or cancel the gamma sensitivity and to improve response instantaneity. A selective measurement of epithermal neutron flux can by this way, made by associating two types of collectrons.

9135 (NKA/LIT—85-4) **Design process and the use of computerized tools in control room design. Final report from the Nordic LIT-3.1 project.** Wahlstroem, B.; Heinonen, R.; Ranta, J.; Haarla, J. (Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark)). Sep 1985. 130p. NTIS (US Sales Only), PC A07/MF A01. File Number DE87750414.

Control room design has proven an important component when the safety and availability of a complex industrial process plant are considered. Many control room deficiencies can be traced back to oversights and other errors during the design process. The introduction of powerful computers and software for computer-aided design (CAD) offers one possibility when tools for improving the quality of design are being selected. The report gives a broad assessment of problems of design and the benefits of using computer-aided design. One proposal for a structure of a computer-aided design system is considered in more detail. In this system special emphasis has been laid on dealing with requirements during design process. A demonstration system has been built and sample system user dialogues are described. The report is the final report of the LIT3.1 project of the Nordic cooperation on human reliability in the energy production field.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 9207, 9912, 9924

9136 (DPST—86-348) **Preliminary report on L-Lake temperature/depth survey of March 17, 1986.** Hayes, D.W.; Cooper, R.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 25 Mar 1986. Contract AC09-76SR00001. 15p. NTIS, PC A02. File Number DE87002643.

Temperature/depth profile measurements were made while L-Reactor was operating on March 17, 1986, at several locations in L-Lake using a calibrated pressure transducer and a copper constantan thermocouple. L-Reactor had operated at full power before these measurements for a period of nearly two weeks during unseasonably warm weather (on March 17, the high temperature for the day was 78°F or 25.5°C). Any interpretation of these data should account for the fact that studies of the L-Lake are insufficient to fully understand the lake dynamics at this time.

9137 (IAEA-R—3776-F) **Influence of aging on the retention of $CH_3$131I by various impregnated activated carbons. Final report for the period 1 July 1984-30 June 1985.** Deuber, H. (International Atomic Energy Agency, Vienna (Austria)). Aug 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700258.

Nuclear power plants are equipped with iodine filters containing impregnated activated carbons to keep the release of airborne radioiodine as low as reasonably achievable. Impregnated activated carbons are known to age, i.e. to deteriorate in performance with respect to the retention of radioiodine, particularly in iodine filters that are continuously operated (e.g. containment exhaust air filters of pressurized water reactors). The aging of carbons in iodine filters is essentially due to the adsorption of organic compounds (e.g. solvents) and of inorganic compounds (e.g. Osub(x), SO_2, NOsub(x)). In the first case the effective surface of the carbon is lowered. In the second case reactions with carbon as well as with the impregnant can occur. In iodine filters various impregnated activated carbons are used differing e.g. in base material, grain size and impregnant. In recent years new impregnated activated carbons were developed. Therefore, investigations are performed to provide comparative data on the aging of a variety of commercial impregnated activated carbons from several countries under relevant conditions. The data relate to the retention of methyl iodide (CH_3I-131). The investigations cover the aging of 15 different impregnated activated carbons in the containment exhaust air of a typical German pressurized water reactor over periods of up to 9 months. 15 refs, 19 figs, 5 tabs.

9138 (INIS-mf—10514, pp vp) **Improvement program of radwaste treatment at Chinshan nuclear power station.** Lin, M.H.; Haung, C.I. (Taiwan Power Company, Republic of China). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 9165, 9195, 9204, 9210, 9815, 9816, 9818, 9822, 10420

9139 (AECL—8841) **Calculational model for the NRU reactor.** Douglas, S.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1985. 9p. (CONF-850609—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700286.

From 25. annual international conference of the Canadian Nuclear Association and 6. annual conference of the Canadian Nuclear Society; Ottawa, Ontario, Canada (2 Jun 1985).

A new computer model to calculate neutronic properties of the NRU research reactor is being implemented at the Chalk River Nuclear Laboratories (CRNL). The model is founded on numerous theoretical studies, on analysis of NRU support experiments done in a zero power reactor, and on comparison with measurements in the NRU reactor. This paper examines the elements of the new calculational model, concentrating on the unique features of NRU and their influences on neutron behaviour.

9140 (CONF-861185—1) **Transition phase of the whole-core demonstration at the Oak Ridge Research Reactor.** Hobbs, R.W.; Bretscher, M.M.; Cornella, R.J.; Snelgrove, J.L. (Oak Ridge National Lab., TN (USA); Argonne National Lab., IL (USA)). 1986. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002178.

From Reduced Enrichment for Research and Test Reactors (RERTR) program international meeting; Gatlinburg, TN, USA (3 Nov 1986).

The transition from operation of the Oak Ridge Research Reactor with high-enrichment uranium (HEU) fuel to operation with low-enrichment uranium (LEU) fuel is nearing completion. The systematics of the replacement of the HEU fuel with the LEU fuel are discussed. The results of the core physics measurements that have been conducted during the transition phase are described.

9141 (IAE—1975/E-3/R/B) **Determining the Bartek fuel rig selected heat parameters - an introduction to the porous layers heat research.** Bykowski, W.; Michalski, Z.; Zajaczkowski, P. (Institute of Atomic Energy, Otwock-Swierk (Poland)). 1983. 22p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

Experimental fuel rig tests are described. The dependences which define both the effective thermal conductivity of a composite layer and the thermal resistance in contact with the layer, and which were obtained after working out the results of the experiments, are presented. A number of practical conclusions and guidelines for future work are presented.

9142 (IAE—1977/E-3/R/B) **Analysis of the working tolerances on the temperature characteristics of the reactor rigs.** Golab, A.; Piastka, J. (Institute of Atomic Energy, Otwock-Swierk (Poland)). 1983. 21p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

Starting from the laboratory measurements, the influence of the working tolerances of the reactor rig elements on the axia temperature distribution is studied. The values of these tolerances are also specified for the temperature range of the rig required by the experiment. The influence of the annular gap dimensions around the central test pipe of the rig is also investigated on the accuracy of the sample temperature.

9143 (INIS-BR—542) **Study of reactivity of fluidized bed nuclear reactor.** Rammsy, J.E.M. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Dept. de Engenharia Nuclear). 1985. 120p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700467.

The reactor physics calculations of a 19 module Fluidized Bed Nuclear Reactor using Leopard and Odog codes are performed. The behaviour of the reactor was studied by calculating the reactivity of the reactor as a function of the parameters governing the operational and accidental conditions of the reactor. The effects of temperature, pressure, and vapor generation in the core on the reactivity are calculated. Also the start up behaviour of the reactor is analyzed. For the purpose of the study of a prototype research reactor, the calculations on a one module reactor have been performed.

9144 (JAERI-M—85-003) **Gamma radiation effects on the mirror surfaces of nickel deposited glass plates.** (Japan Atomic Energy Research Inst., Tokyo). Feb 1985. 17p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700287.

The effects of ^{60}Co gamma radiation on the mirror surfaces of nickel deposited glass plates, which were planned to be used as the neutron guide tubes in the upgraded JRR-3, were examined by visual tests, surface flatness measurements and X-ray diffraction. After irradiation at a dose of 10^8 rad in air atmosphere, a good number of small spots were seen on the mirror surface. In the case of 10^9 rad irradiation in air atmosphere the spots were enlarged and a few new peaks were observed in the X-ray diffraction patterns. On the other hand, in vacuum and helium atmosphere, the nickel deposited mirror surfaces were not changed appreciably, even after irradiating to 10^9 rad.

9145 (Juel-Spez—316, pp 158-161) **Report on the optimization calculations for the FRM compact core.** Boening, K.; Glaeser, W.; Meier, J.; Rau, G.; Roehrmoser, A.; Zhang, L. (Technische Univ. Muenchen, Garching, Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9146 (Juel-Spez—316, pp 162-165) **Status of the realization of a UKN plant at the high-flux reactor Grenoble.** Steyerl, A.; Gaehler, R.; Steinhauser, K.A. (Technische Univ. Muenchen, Garching, Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

In collaboration with the ILL and with support of the BMFT an intensive source of ultracold and cold neutrons is constructed at the Grenoble reactor. (BHO).

9147 (KURRI-TR—249, pp 1-9) **Experiments of low temperature irradiations in Kyoto University reactor. Past, present and future.** Shibata, Toshikazu. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

The existing Kyoto University reactor (KUR) is of power output 5000 kW and fast neutron flux 1 x 10^{12} fn/cm^2 sec, and will commemorate the 20 years anniversary of the criticality in June, 1984. The low temperature irradiation facility installed in the E-4 experimental hole of the KUR has been used for 14 years for common utilization experiments. The renewal of the compressor and refrigerator and the repair of the safety system of the vacuum system were carried out in 1973. The results of the research on the low temperature irradiation facility of the KUR and the themes of the common utilization experiments using the facility show the demand of users penetrating into diverse fields. The plan of the Kyoto University high neutron flux reactor (KUHFR) has been advanced to meet the demand, but the consent of the related community was not able to be obtained. The plan of installing the vertical low temperature irradiation facility as well as the cold neutron source in the KUR is forwarded. The existing low temperature irradiation facility carries out the continuous irradiation for 80 hours at 20 K. The necessity of the vertical low temperature irradiation facility, the outline of its equipment and the contents of research are described.

9148 (KURRI-TR—249, pp 10-18) **Existing and projected neutron sources and low-temperature irradiation facilities in Germany.** Boening, K. (Technische Univ. Muenchen, Germany, F.R.). 1984. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

In this paper, a contribution given at the Kyoto University Research Reactor Institute to the temporal meeting on the design of the facilities for high flux, low temperature irradiation is summarized. The following five subjects were discussed. The project of modernizing the swimming pool type research reactor FRM with 4 MW power at Munich is to achieve relatively high thermal neutron flux, and an extremely compact core is designed. The existing low temperature irradiation facility (LTIF) of the FRM is the most powerful in the world, and has been successfully operated more than 20 years. The fast and thermal neutron fluxes are 2.9 x 10^{13} and 3.5 x 10^{13} $/cm^2$ sec, respectively. The experimental techniques in the LTIF of the FRM, such as a measuring cryostat, the mounting of irradiated samples and so on, are described. The installation of new LTIFs in connection with the projects of advanced neutron sources in Germany is likely to be made in the modernized FRM at Garching, in the spallation neutron source SNQ at KFA Juelich and so on. The interesting problems in fundamental and applied researches with LTIFs, and the unusual application of LTIFs are shown.

9149 (KURRI-TR—249, pp 29-33) **Studies on radiation damages at low-temperature in JAERI.** Okuda, Shigeo. (Tsukuba Univ., Sakura, Ibaraki, Japan). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

The liquid helium temperature loop (LHTL) in the Japan Atomic Energy Research Institute started the irradiation experiment at extremely low temperature in 1967, and has achieved many results in the development of the experimental means at liquid helium temperature, the basic research on irradiation damage and others. However, the LHTL was to be removed in 1983 accompanying the reconstruction of JRR-3 in which it was installed. In order to meet the demand of increased irradiation quantity, No. 2 LHTL has been planned since 1972, but at present, it is in the state of stop. This plan is briefly described. As the plan of the No. 2 LHTL, the swimming pool type JRR-4 was selected to install it. The specifications are: power output 2.5 MW, temperature 4.5 K, fast and thermal neutron fluxes 1 x 10^{13} and 2 x 10^{13} n/cm^2 sec, cooling power 200 W, gamma heating 0.2 W/g, and irradiation cylinder vertical. The irradiation plug is inserted in place of one fuel element, and about 50 g of B-10 removes thermal neutrons, and Pb sheath reduces gamma-ray. As one of the important themes in the irradiation experiment at extremely low temperature, the problem of the distribution of irradiation defects, that is, the distance of substitution collision, is considered.

9150 (KURRI-TR—268, pp 5-8) **Safety system and 10 years experience in the maintenance of Kyoto University Critical Assembly.** Nakamura, Hiroshi; Ishihara, Shinji; Tsujimoto, Hitomi; Kobayashi, Tooru; Ikegawa, Ryusho; Shibata, Toshikazu. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.). 1985. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780040. (CONF-8408209—).

From Development of advanced technology for scientific research conference; Kumatori, Osaka, Japan (7 Aug 1984).

Kyoto University Critical Assembly (KUCA) is a new type facility for joint use program among universities and research institutes. It consists of two solid-moderated cores and a water-moderated core. In order to keep safe operation of the critical assembly, safety system has been designed to meet the complex operating systems. The first critical experiment of KUCA was performed in August 1974. Since then, this safety system has served for the safety operation of KUCA. In the present report, the outline of this system and the maintenance are described.

9151 (KURRI-TR—268, pp 17-20) **Report on material tests for fabrication of the KUHFR reflector tank.** Araki, Y. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.). 1985. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780040. (CONF-8408209—).

From Development of advanced technology for scientific research conference; Kumatori, Osaka, Japan (7 Aug 1984).

The Kyoto University High Flux Reactor (KUHFR) is designed to have a pair of cylindrical core vessels made of aluminium and a spherical reflector tank made of stainless steel SUS316L containing the core vessels. The cooling and moderating light water flows downward. The reflector tank is a good neutron moderator to offer a proper thermal neutron field for various irradiations and beam experiments. Many kinds of tests, for examples, metallographic microstructure observations, mechanical tests and corrosion tests were carried out for SUS316L specimens treated under various conditions.

9152 (NUCLEBRAS-CDTN—532) **Modifications done in the IPR-R1 reactor and their auxiliary systems.** Maretti Junior, F.; Amorim, V.A. de; Coura, J.G. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1986. 16p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700468.

The improvements done in the IPR-R1 reactor for adequateness of operation conditions and increase of irradiation sample capability. The cooling systems, reactor pool, system of control rods were substituted. The optimization of transfer pneumatic system was done. (M.C.K.).

9153 (NUCLEBRAS-CDTN—535) **Preparation fo nuclear research reactors operators.** Roedel, G. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1986. 9p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700469.

The experience obtained with the training of operators of nuclear research reactors is presented. The main tool used in the experiments is the IPR-R1 reactor, a TRIGA MARK I type, owned by Nuclear Technology Development Centre (CDTN) of NUCLEBRAS. The structures of the Research Reactors Operators Training Course and of the Radiological Protection Course, as well as the Operators Qualifying and Requalifying Program, all of them prepared at CDTN are also presented. Mention is made of the application of similar experiments to other groups, such as students coming from Nuclear Sciences and Techniques Course of the Federal University of Minas Gerais.

9154 (NUREG/CR—4684-Vol.1) **PBF [Power Burst Facility] severe fuel damage test 1-1: Volume 1, Test results report.** Martinson, Z.R.; Petti, D.A.; Cook, B.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1986. Contract AC07-76ID01570. 152p. (EGG—2463-Vol.1). NTIS, PC A08/MF A01 - GPO. File Number TI87003028.

A comprehensive evaluation of the Severe Fuel Damage (SFD) Test 1-1 performed in the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory is presented. The test is part of an internationally sponsored light water reactor severe accident research program, initiated by the US Nuclear Regulatory Commission. Test SFD 1-1 was the second of four nuclear severe fuel damage tests performed in the PBF. The overall technical objective of the test was to contribute to the understanding of fuel bundle dynamics, hydrogen generation and fission product behavior during a high temperature, severe damage transient. The SFD 1-1 fuel bundle comprised 32, 0.9-m long, trace-irradiated (79 MWd/t) fuel rods surrounded by an insulating shroud. The experiment consisted of a transient in which the inlet coolant flow to the test bundle was reduced to 0.64 g/s, while the nuclear power was gradually increased until dryout, heatup, and rapid oxidation occurred. With sustained power and the heat of oxidation, temperatures continued to rise rapidly, approaching fuel melting and resulting in zircaloy melting, fuel liquefaction, material relocation, and fission product release. The ~1 h transient, conducted at a pressure of 6.8 MPa, was terminated over a 1200-s time span by reducing the reactor power and cooling the bundle with an argon sweep gas before reflooding the bundle. A description and evaluation of the major phenomena, based upon the response of on-line instrumentation, analysis of fission product data, postirradiation examination of the fuel bundle, and calculations using the Severe Core Damage Analysis Package (SCDAP) Code, are presented.

9155 (NUREG/CR—4684-Vol.2) **PBF [Power Burst Facility] severe fuel damage test 1-1: Volume 2, Test results report, Appendices A through I.** Martinson, Z.R.; Petti, D.A.; Cook, B.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1986. Contract AC07-76ID01570. 304p. (EGG—2463-Vol.2). NTIS, PC E12/MF $7.30 - GPO. File Number TI87003042.

Includes 10 sheets of 48x reduction microfiche.

This report provides information on: fuel rod characteristics; instrumentation identification, location, and performance; effluent sampling and monitoring system; bundle power; test SFD 1-1 data qualification, uncertainties, and data plots; postirradiation examinations; chemical kinetics predictions; SCDAP analysis model; and coolant level measurements.

9156 **(ORNL—6324) Reevaluation of HFIR source term: Supplement 2.** Thomas, W.E. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002970.

The HFIR source term has been reevaluated to assess the impact of the increase in core lifetime from 15 to 24 days. Calculations were made to determine the nuclide activities of the iodines, noble gases, and other fission products. The results show that there is no significant change in off-site dose due to the increased fuel cycle for the release scenario postulated in ORNL-3573.

9157 **(ORNL/TM—10275) Bulk shielding facility: Quarterly report, July, August, and September 1986.** Hamrick, T.P.; Muggridge, F.E. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002976.

The BSR operated at an average power level of 138 kW for 7.2% of the time during July, August, and September. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The PCA is shutdown for shim-safety rod magnets and associated electronic components upgrading.

9158 **Monte Carlo analysis of aqueous /sup 235/U critical assemblies with ENDF/B-V data.** Rose, P.F. (Brookhaven National Lab., Building 197D, Upton, NY 11973). *Nuclear Science and Engineering;* **94**: No. 1, 36-41(Sep 1986).

Ten aqueous homogeneous critical assemblies were analyzed with ENDF/B-V data by means of the SAM-CE continuous energy Monte Carlo code. Calculated k/sub eff/ values are consistent with experiment for large, dilute assemblies but become systematically as much as 1% too large for assemblies with both high leakage and hard flux spectra. Adjustments of k/sub eff/ to measured capture and fission integrals indicate improvements that should be investigated further.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 9126, 10296

2209 Reactor Safety

REFER ALSO TO CITATION(S) 9001, 9948, 10650

9159 **(AECL—8777) Simple method for computing mean fuel temperatures during a reactor transient.** Selander, W.N. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700281.

A first-order equation for the kinetics of the mean temperature in a cylindrical fuel rod is derived by averaging the time-dependent heat equation over the fuel cross section. Flux depression is included but has a relatively minor effect on the fuel time constant. The resulting equation is useful in thermalhydraulic transient simulations.

9160 **(BNL-NUREG—38916) BWR plant analyzer development at BNL [Brookhaven National Laboratory].** Wulff, W.; Cheng, H.S.; Mallen, A.N. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 12p. (CONF-8610135—38). NTIS, PC A02/MF A01 - GPO. File Number TI87003212.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

An engineering plant analyzer has been developed at BNL for realistically and accurately simulating transients and severe abnormal events in BWR power plants. Simulations are being carried out routinely with high fidelity, high simulation speed, at low cost and with unsurpassed user convenience. The BNL Plant Analyzer is the only operating facility which (a) simulates more than two orders-of-magnitude faster than the CDC-7600 mainframe computer, (b) is accessible and fully operational in on-line interactive mode, remotely from anywhere in the US, from Europe or the Far East (Korea), via widely available IBM-PC compatible personal computers, standard modems and telephone lines, (c) simulates both slow and rapid transients seven times faster than real-time in direct access, and four times faster in remote access modes, (d) achieves high simulation speed without compromising fidelity, and (e) is available to remote access users at the low cost of $160 per hour.

9161 **(CEA-IPSN—2-Rev.1) Accident of Chernobyl.** (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). 21 May 1986. 80p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750726.

First, R.M.B.K type reactors are described. Then, safety problems are dealt with: reactor control, behavior during transients, normal loss of power and behavior of the reactor in case of leak. A possible scenario of the accident of Chernobyl is proposed: events before the explosion, possible initiators, possible scenario and events subsequent to the core meltdown (corium - concrete interaction, interaction with the groundwater table). An estimation of the source term is proposed first from the installation characteristics and the supposed scenario of the accident, and from the measurements in Europe; radiological consequences are also estimated. Radioactivity measurements (Europe, Scandinavia, Western Europe, France) are given in tables (meteorological maps and fallouts in Europe). Finally, the future of the reactor, its site and its neighbourhood is evoked.

9162 **(CONF-8610135—9) Containment venting as a mitigation technique for BWR Mark I plant ATWS.** Harrington, R.M. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 26p. NTIS, PC A03. File Number DE87002179.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Containment venting is studied as a mitigation strategy for preventing or delaying severe fuel damage following hypothetical BWR Anticipated Transient Without SCRAM (ATWS) accidents initiated by MSIV-closure, and compounded by failure of the Standby Liquid Control (SLC) system injection of sodium pentaborate solution and by the failure of manually initiated control rod insertion. The venting of primary containment after reaching 75 psia (0.52 MPa) is found to result in the release of the vented steam inside the reactor building, and to result in inadequate Net Positive Suction Head (NPSH) for any system pumping from the pressure suppression pool. CONTAIN code calculations show that personnel access to large portions of the reactor building would be lost soon after the initiation of venting and that the temperatures reached would be likely to result in independent equipment failures. It is concluded that containment venting would be more likely to cause or to hasten the onset of severe fuel damage than to prevent or to delay it.

9163 **(CONF-8610135—33) Effects of lateral separation of oxidic and metallic core debris on the BWR MK I containment drywell floor.** Hyman, C.R.; Weber, C.F. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001833.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

In evaluating core debris/concrete interactions for a BWR MK I containment design, it is common practice to assume that at reactor vessel breach, the core debris is homogeneous and of low viscosity, so that it flows through the pedestal doorway and spreads in a radially uniform fashion throughout the drywell floor. In a recent study performed by the NRC-sponsored Boiling Water Reactor Severe Accident Technology (BWRSAT) program at Oak Ridge National Laboratory, calculations indicate that at reactor vessel bottom head failure, the debris temperature is such that the debris metals (Zr, Fe, Ni, Cr) are completely molten while the oxides (UO_2, ZrO_2, FeO) are completely frozen. Thus, the frozen oxides are expected to remain within the reactor pedestal while the molten metals radially separate from the frozen oxides, flow through the reactor pedestal doorway, and spread over the annular region of the drywell floor between the pedestal and the containment shell. This paper assesses the impact on calculated debris gas releases and the production and release of fission product-laden aerosols for two different cases of debris distribution: uniform distribution and the laterally separated case of 95% oxides-5% metals inside the pedestal and 5% oxides-95% metals outside the pedestal. The computer codes used are CORCON-MOD2, MARCON 2.1B and VANESA.

9164 **(CONF-8610135—41) Role of BWR MK I secondary containments in severe accident mitigation.** Greene, S.R. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002180.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The recent advent of detailed containment analysis codes such as CONTAIN and MELCOR has facilitated the development of the first large-scale, architectural-based BWR secondary containment models. During the past year ORNL has developed detailed, plant-specific models of the Browns Ferry and Peach Bottom secondary containments, and applied these models in a variety of studies designed to evaluate the role and effectiveness of BWR secondary containments in severe accident mitigation. The topology and basis for these models is discussed, together with some of the emerging insights from these studies.

9165 **(DEMO—84/2) An assessment of the individual and social risk resulting from a hypothetical Greek research reactor-1 loss-of-coolant-accident release for Athens population.** Kollas, J.; Synodinou, V.; Varsamis, G.; Antoniades, J.; Catsaros, N. (Democritos Nuclear Research Center, Athens (Greece)). Mar 1984. 44p. NTIS (US Sales Only), PC A03. File Number DE87900235.

In this report the Loss-of-Coolant-Accident consequences of the Greek Research Reactor-1, a 5 MW open pool type research reactor located within the limits of Athens, the largest population center or Greece, are estimated. The source term emerges from a conservative 20% coremelt with 25 isotopes taken into consideration. Individual and social risk are calculated to a distance of 20 km from the reactor site, an area covering all of the Athens region with 3,081,000 inhabitants. Latent health effects due to both initial and chronic exposure from inhalation of resuspended radionuclides and exposure to groundshine from contaminated ground are assessed.

9166 **(DEMO—84/11) An assessment of the consequences of the Greek Research Reactor's design basis accident: Sensitivity to the meteorological record.** Kollas, J.; Tombrou, M. (Democritos Nuclear Research Center, Athens (Greece)). Oct 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87900228.

The sensitivity of the Greek Research Reactor's design basis accident consequences to the meteorological record, as far as Athens population is concerned, is assessed in this report. Meteorological data of six years of the National Observatory of Athens are analyzed and utilized in the accident consequence calculation model by using weather categories. The results of the present analysis indicate that the meteorological record does not have a significant impact on predicted consequences, which in turn indicates that the utilization of a substitute meteorological record from a nearby meteorological station instead of the reactor's site record could be acceptable for performing consequence analyses.

9167 **(EGG-M—14086) An evaluation of information sources and requirements for nuclear plant-aging research with life-extension implications.** Jacobs, P.T. (EG and G Idaho, Inc., Idaho Falls (USA)). 24 Oct 1986. Contract AC07-76ID01570. 6p. (CONF-861007—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002611.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

Information requirements for plant-aging and life-extension research are discussed. Various information sources that have been used in plant-aging studies and reliability assessments are described. Data-base searches and analyses were performed for a specific system using several data bases and plant sources. Comments are provided on the results using the various information sources.

9168 **(EGG-M—21486) Parameters important to reactor coolant pump seal stability during station blackout.** Hill, R.C.; Rhodes, D.B. (EG and G Idaho, Inc., Idaho Falls (USA); Atomic Energy of Canada Ltd., Chalk River, Ontario). 24 Oct 1986. Contract AC07-76ID01570. 13p. (CONF-8610135—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002601.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

An assessment is made of the ability of typical Reactor Coolant Pump (RCP) Shaft Seals to withstand the conditions predicted for a station blackout (loss of all alternating current power) at a nuclear power station. Several factors are identified that are key to seal stability including inlet fluid conditions, pressure downstream of the seal, and geometrical details of the seal rings. Limits for stable seal operation are determined for various combinations of these factors, and the conclusion is drawn that some RPC seals would be near or over the threshold of instability during a station blackout. If the threshold were exceeded, significant leakage of coolant from the primary coolant system could be expected.

9169 **(EGG-M—21586) Dynamic load effects on gate valve operability.** Steele, R. Jr.; MacDonald, P.E.; Arendts, J.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 12p. (CONF-8610135—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002599.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Idaho National Engineering Laboratory (INEL) participated in an internationally sponsored seismic research program conducted at the decommissioned Heissdampfreaktor (HDR) located in the Federal Republic of Germany. An existing piping system was modified by installation of an 8-in., naturally aged, motor-operated gate valve from a US nuclear power plant and a piping support system of US design. Six other piping support systems of varying flexibility from stiff to flexible were also installed at various times during the tests. Additional valve loadings included internal hydraulic loads and, during one block of tests, elevated temperature. The operability and integrity of the aged gate valve and the dynamic response of the various piping support system were measured during 25 representative seismic events.

9170 **(EGG-M—22086) System Analysis and Risk Assessment (SARA) system.** Krantz, E.A.; Russell, K.D.; Stewart, H.D.; Van Siclen, V.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 25 Oct 1986. Contract AC07-76ID01570. 16p. (CONF-8610135—19). NTIS, PC A02/MF A01 - GPO; 1; GPO Dep. File Number DE87002616.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Utilization of Probabilistic Risk Assessment (PRA) related information in the day-to-day operation of plant systems has, in the past, been impracticable due to the size of the computers needed to run PRA codes. This paper discusses a microcomputer-based database system which can greatly enhance the capability of operators or regulators to incorporate PRA methodologies into their routine decision making. This system is called the System Analysis and Risk Assessment (SARA) system. SARA was developed by EG and G Idaho, Inc. at the Idaho National Engineering Laboratory to facilitate the study of frequency and consequence analyses of accident sequences from a large number of light water reactors (LWRs) in this country. This information is being amassed by several studies sponsored by the United States Nuclear Regulatory Commission (USNRC). To meet the need of portability and accessibility, and to perform the variety of calculations necessary, it was felt that a microcomputer-based system would be most suitable.

9171 **(EGG-M—22286) Small break LOCA [loss of coolant accident] mitigation for Bellefonte.** Bayless, P.D.; Dobbe, C.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 15p. (CONF-8610135—23). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002613.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Several 5-cm (2-in.) diameter cold leg break loss coolant accidents for the Bellefonte nuclear plant were analyzed as part of the Severe Accident Sequence Analysis Program. The transients assumed various system failures, and included the S_2D sequence. Operator actions to mitigate the S_2D transient were also investigated. The transients were analyzed until either core damage began or long-term decay heat removal was established. The S_2D sequence was analyzed into the core damage phase of the transient. The analyses showed that the flow from one high pressure injection pump was necessary and sufficient to prevent core damage in the absence of operator actions. Operator actions were also able to prevent core damage for the S_2D sequence.

9172 **(EGG-M—22486) Evaluation of scaling concepts for integral system test facilities.** Condie, K.G.; Larson, T.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 24 Oct 1986. Contract AC07-76ID01570. 22p. (CONF-8610135—18). NTIS, PC A02/MF A01 - GPO; 1; GPO Dep. File Number DE87002618.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

A study was conducted by EG and G Idaho, Inc., to identify and technically evaluate potential concepts which will allow the United States Nuclear Regulatory Commission to maintain the capability to conduct future integral, thermal-hydraulic facility experiments of interest to light water reactor safety. This paper summarizes the methodology used in the study and presents rankings for each facility concept relative to its ability to simulate phenomena identified as important in selected reactor transients in Babcock and Wilcox and Westinghouse large pressurized water reactors. Established scaling methodologies are used to develop potential concepts for scaled integral thermal-hydraulic experiment facilities. Concepts selected included: full height, full pressure water; reduced height, reduced pressure water; reduced height, full pressure water; one-tenth linear, full pressure water; and reduced height, full scaled pressure Freon. Results from this study suggest that a facility capable of operating at typical reactor operating conditions will scale most phenomena reasonably well.

9173 **(EGG-M—22586) Semiscale recovery investigations: A comparison of results from semiscale Mod-2C small break LOCA [loss-of-coolant accidents] without HPI [high pressure injection] tests.** Streit, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 23 Oct 1986. Contract AC07-76ID01570. 26p. (CONF-8610135—26). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002617.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Inadequate core cooling conditions can result in small break loss-of-coolant accidents (SBLOCAs) without high pressure injection (HPI) unless appropriate operator action is taken. Results from the S-NH test series, performed in the Semiscale Mod-2C facility, show that for SBLOCAs below 2.1% inadequate core cooling results before the accumulator actuation pressure is reached. Various recovery operations were used in the experiments in the S-NH test series to mitigate the heater rod temperature excursions and lower the primary system pressure to the accumulator actuation pressure. These recovery operations included steam generator secondary steam-and-feed and primary coolant pump restart. In addition, in one of the experiments steam generator secondary steam-and-feed operations were begun before a heater rod temperature excursion began. The effectiveness each procedure had in mitigating the heater rod temperature excursions is discussed and compared.

9174 **(EGG-M—22786) RELAP5/MOD2 development.** Miller, C.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 23 Oct 1986. Contract AC07-76ID01570. 7p. (CONF-8610135—25). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002619.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Status of the RELAP5/MOD2 computer code is discussed. While the code is undergoing international assessment, emphasis is on user support and code maintenance with modifications allowed only for error correction and user convenience improvements. User support discussed is the response to user inquiries, maintenance of manuals and the implementation of a PC based newletter service. The major 1986 user convenience improvement is the self-initialization option. The method is discussed and examples for PWR "U tube" and "once through" plants are illustrated. Future plans are also outlined.

9175 **(EGG-M—23286) An interim assessment of reactor protection system aging.** Jacobs, P.T. (EG and G Idaho, Inc., Idaho Falls (USA)). 24 Oct 1986. Contract AC07-76ID01570. 18p. (CONF-8610135—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002598.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

An interim assessment of reactor protection system aging is presented. The research approach is a Phase I study for the Nuclear Plant Aging Research Program of the United States Nuclear Regulatory Commission. Results addressing each of the program's technical objectives are presented. Plans for continuation of the work into Phase II are discussed.

9176 **(EGG-M—25686) Update on standard problem, data base, and uncertainties.** Golden, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 5 Nov 1986. Contract AC07-76ID01570. 13p. (CONF-8610135—28). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002606.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Three Mile Island (TMI)-2 accident provides the only data for a full-scale, integrated water reactor facility during a severe accident. The data from this accident has been, and is being, collected, reviewed, and cataloged. The data will be placed in structured data bases. To date, three data bases have been completed: Plant Configuration, Sequence of Events, and Initial and Boundary Conditions. The data pertinent to the TMI-2 Standard Problem have been reviewed and categorized by type and level of uncertainty. As a result of the review process, it has been determined that further refinement of the estimated boundary conditions High Pressure Injection/makeup and letdown flow will be required. A demonstration calculation for the first 174 min of the accident has been completed using the RELAP/SCDAP integrated code. This calculation is in general agreement with the data for the first 100 min of the accident and in significantly less agreement beyond 100 min. Refinement of the model's nodalization is expected to correct some of the inconsistencies.

9177 **(EGG-M—34086) Risk evaluations of aging phenomena: The linear aging reliability model and its extensions.** Vesely, W.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 28 Oct 1986. Contract AC07-76ID01570. 18p. (CONF-8610135—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002607.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

A model for component failure rates due to aging mechanisms has been developed from basic phenomenological considerations. In the treatment, the occurrences of deterioration are modeled as following a Poisson process. The severity of damage is allowed to have any distribution, however the damage is assumed to accumulate independently. Finally, the failure rate is modeled as being proportional to the accumulated damage. Using this treatment, the linear aging failure rate model is obtained. The applicability of the linear aging model to various mechanisms is discussed. The model can be extended to cover nonlinear and dependent aging phenomena. The implementability of the linear aging model is demonstrated by applying it of the aging data collected in NRC's Nuclear Plant Aging Research (NPAR) Program. The applications show that aging as observed in collected data have significant effects on the component failure probability and component reliability when aging is not effectively detected and controlled by testing and maintenance.

9178 **(ENEA-RT-TERM—86/4) Critical flows in nuclear reactor safety.** Celata, G.P.; D'Annibale, F.; Farello, G.E.; Cumo, M. (ENEA, Casaccia (Italy). Dipartimento Reattori Termici; Rome Univ. (Italy)). May 1986. 26p. (CONF-8605211—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900295.

From 2. Latin American congress on heat and mass transfer; San Paulo, Brazil (12 May 1986).

Referring to a Loss-of-Coolant Accident situation in LWRs, an analysis of the two-phase critical flow has been performed. Several aspects of the phenomenon have been investigated: metastability delays in vaporization under quick depressurization; flow pattern inside the discharging channel; flow pattern and pressure distribution inside the unbounded two-phase jet region; and critical specific mass flowrate prediction by means of a theoretical correlation.

9179 **(EPRI-NP—4874-Vol.1) Graphic display development methodology: Volume 1, Theory: Final report.** Pankrantz, D. (Operations Engineering, Inc., Fremont, CA (USA)). Nov 1986. 507p. NTIS, PC A22/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. File Number DE87003332.

The Graphic Display Development Program is intended to develop computer-based displays which support the symptomatic emergency operating procedures for BWRs. The purpose is to provide a technical basis and methodology for linking two post-TMI safety initiatives: improved operating procedures and the Safety Parameter Display System (NUREG-0737 Supplement 1). Whereas consistency between displays and emergency operating procedures is desirable, no assumption of such an NRC requirement is either expressed or implied in this document. Accordingly, this program should be viewed not as the only acceptable approach to SPDS design but as one of many possible approaches which may be pursued. This program has been supported as a generic activity on behalf of the Boiling Water Reactor Owner's Group (BWROG). No endorsement by any individual utility member of the BWROG is either expressed or implied in this document, nor is any utility obligated to implement this program at any plant.

9180 **(EPRI-NP—4899) Analysis of in-pile heat transfer tests: Final report.** Rowe, D.S.; Nielsen, L.H.; Henke, R.K. (Rowe and Associates, Bellevue, WA (USA)). Nov 1986. 123p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920141.

This report presents the results of analysis of selected data from the NRU test series dealing with heatup and reflood heat transfer during postulated PWR LOCA conditions. These tests used nuclear fuel rods and some considered clad ballooning and rupture. Also included was an electrically-heated rod ballooning test, REBEKA-6. The COBRA-TF computer program, renamed PYTHONS, was modified and used for the analytical tool. Modifications included provisions for fuel rod gas flow and pressure, creep deformation and rupture, channel blockage, and blockage heat transfer. Calculated clad temperatures for NRU unpressurized rods show quite good agreement with experimental data. The calculated amount and axial extent of clad ballooning for pressurized rods agrees reasonably well with post-test examinations of the NRU bundles. Time to failure was underpredicted in the MT-3 test as a result of the high strength of NRU clad material which was not represented in the PYTHONS creep strain correlation. Use of an alternate creep model in the REBEKA-6 analysis showed excellent prediction of time to failure. Fine detail in the deformation profile caused by the cooling effects of grid spacers was not calculated by the code. Further analytical development would be needed to include this effect.

9181 **(EPRI-NP—4942) Further studies of degraded core coolability: The effect of pressure and coolant flow from below: Interim report.** Tsai, F.P.; Jakobsson, J.O.; Catton, I. (California Univ., Los Angeles (USA)). Nov 1986. 123p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920129.

An experimental investigation was made to study dryout of a bed of inductively heated particles, cooled by an overlying liquid pool and a through flow of coolant or gas. Stainless steel particles of diameters .59 to .79 mm, 1.6 mm, 3.2 mm, and 4.8 mm were used. Freon-113, acetone, methanol and water were used as coolants and pressure was varied from 1 to 5.76 atm-abs. Bed height was varied from 8.0 cm to 21.0 cm and the overlying liquid ratio (liquid depth to bed height) was varied from 0.0 to 2.0. At 1 atm. abs. pressure the through flow was also varied. The measured dryout heat flux was found to increase with increased pressure and usually lower than predicted by available analytical models. The coolant above the bed was found to have little effect at higher pressures. The dryout heat flux also increased as the inlet flow increased and asymptotically approached the total evaporation energy of the inlet flow. The experimental measurements of dryout heat flux as a function of pressure were scaled so the reduced dryout heat flux was a function of reduced pressure and geometry only. The scaled Freon-113 results represent water up to 37.3 atm. The effect of gas flow from below on dryout was also studied experimentally. Freon-113 and water were used as coolants and gas mass flux varied from 0 to 0.211 kg/m^2sec. The dryout heat flux decreases as a result of increased bottom gas flow. The gas flow was found to have a stronger effect on small particle beds.

9182 **(GRS-F—148) Surveys of research projects concerning nuclear facility safety, financed by the Federal Ministry of the Interior. 10. Annual report on SR-projects 1985.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). May 1986. 268p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87750323.

Each progress report is a collection of individual reports, categorized by subject matter. They are a documentation of the contractor's progress, rendered by themselves on standardized forms, published, for the sake of general information on progress made in investigations concerning reactor safety, by the project attendance department of the GRS. The individual reports have serial numbers. Each report includes particulars of the objective, work carried out, results obtained and plans for project continuation.

9183 **(GRS-F—152) List of reports in the field of reactor safety research sponsored by BMFT, CEA, EPRI, JSTA and USNRC. Reported period: April 1-June 30, 1986.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Aug 1986. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750322.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning single problems in the field of Reactor Safety Research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Programm of the BMFT, reporting organization. The list of reports appears quarterly.

9184 **(ICP-CEH—129) Chernobyl reactor accident. Report of a consultation 6 May 1986 (Provisional).** (World Health Organization, Copenhagen (Denmark). Regional Office for Europe). May 1986. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700223.

Following the accident at Chernobyl nuclear reactor, WHO organized on 6 May 1986 in Copenhagen a one day consultation of experts with knowledge in the fields of meteorology, radiation protection, biological effects, reactor technology, emergency procedures, public health and psychology in order to analyse the development of events and their consequences and to provide guidance as to the needs for immediate public health action. The present report provides detailed information on the transportation and dispersion of the radioactive material in the atmosphere, especially volatile elements, during the release period 26 April - 5 May. Presented are the calculated directions and locations of the radioactive plume over Europe in the first 5 days after the accident, submitted by the Swedish Meteorological and Hydrological Institute. The calculations have been made for two heights, 1500m and 750m and the plume directions are grouped into five periods, covering five European areas. The consequences of the accident inside the USSR and the radiological consequences outside the USSR are presented including the exposure routes and the biological effects, paying particular attention to iodine-131 effects. Summarized are the first reported measured exposure rates above background, iodine-131 deposition and concentrations in milk and the remedial actions taken in various European countries. Concerning the cesium-137 problem, based on the UNSCEAR assessment of the consequences of the nuclear fallout, one concludes that the cesium contamination outside the USSR is not likely to cause any serious problems. Finally, the conclusions and the recommendations of the meeting, taking into account both the short-term and longer term considerations are presented. 11 figs, 1 tab.

9185 (INIS-BR—539) **Project assembling and commissioning of a rewetting test facility.** Rezende, H.C. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Engenharia Nuclear). Aug 1985. 137p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87700462.

A test facility (ITR - Instalacao de Testes de Remolhamento) has been erected at the Thermal-hydraulics Laboratory of CDTN, dedicated to the investigation of the basic phenomena that can occur during the reflood phase of a Loss of Coolant Accident (LOCA) in a Pressurized Water Reactor (PWR), utilizing tubular and annular test sections. The present work consists in a presentation of the facility design and a report of its commissioning. The mechanical aspects of the facility, its power supply system and its instrumentation are described. The results of the instruments calibration and two operational tests are presented and a comparison is done with calculations perfomed usign a computer code.

9186 (INIS-mf—10512, pp 15) **Chernobyl reactor accident and its radiological implications for Austria.** Tschirf, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9187 (INIS-mf—10514, pp vp) **Radioactive fall-out from the Chernobyl disaster, and its aftermath in Central Europe.** Mueller-Broich, A. (Institute for Biophysics and Physical Biochemistry, University of Regensburg, Federal Republic of Germany). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9188 (JAERI-M—85-013) **Structural modification of the two dimensional fuel behaviour analysis code FEMAXI-III with high-speed vectorized operation.** Yanagisawa, Kazuaki; Ishiguro, Misako; Yamazaki, Takashi; Tokunaga, Yasuo. (Japan Atomic Energy Research Inst., Tokyo; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1985. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700312.

Though the two-dimensional fuel behaviour analysis code FEMAXI-III has been developed by JAERI in form of optimized scalar computer code, the call for more efficient code usage generally arized from the recent trends like high burn-up and load follow operation asks the code into further modification stage. A principal aim of the modification is to transform the already implemented scalar type subroutines into vectorized forms to make the programme structure efficiently run on high-speed vector computers. The effort of such structural modification has been finished on a fair way to success. The benchmarking two tests subsequently performed to examine the effect of the modification led us the following concluding remarks: (1) In the first benchmark test, comparatively high-burned three fuel rods that have been irradiated in HBWR, BWR, and PWR condition are prepared. With respect to all cases, a net computing time consumed in the vectorized FEMAXI is approximately 50 % less than that consumed in the original one. (2) In the second benchmark test, a total of 26 PWR fuel rods that have been irradiated in the burn-up ranges of 13-30 MWd/kgU and subsequently power ramped in R2 reactor, Sweden is prepared. In this case the code is purposed to be used for making an envelop of PCI-failure threshold through 26 times code runs. Before coming to the same conclusion, the vectorized FEMAXI-III consumed a net computing time 18 min., while the original FEMAXI-III consumed a computing time 36 min. respectively. (3) The effects obtained from such structural modification are found to be significantly attributed to saving a net computing time in a mechanical calculation in the vectorized FEMAXI-III code.

9189 **(KTA-GS—49) KTA status report II/1985.** (Kerntechnischer Ausschuss (KTA), Koeln (Germany, F.R.)). Jan 1986. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750321.

The Status Report II/85 gives an account of the KTA activities and achievements in the regulatory sector in the period between the 37th and 38th KTA meeting (June 5 to December 3, 1985). The survey of rules and codes approved of has been elaborated in cooperation with the chairmen of the working groups and sub-committees. The report is intended to provide quick information on developments in the nuclear regulatory system. Information on regulatory work in progress is given in the KTA manual, indicating changes e.g. in subject fields, technical details, time-schedules, or members of working groups. The KTA manual is a looseleaf collection and is regularly updated.

9190 **(LA-UR—86-3690) Nuclear Plant Data Bank.** Booker, C.P.; Turner, M.R.; Spore, J.W. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 10p. (CONF-8610135—22). NTIS, PC A02/MF A01 - GPO. File Number TI87001983.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Nuclear Plant Data Bank (NPDB) is being developed at the Los Alamos National Laboratory to assist analysts in the rapid and accurate creation of input decks for reactor transient analysis. The NPDB will reduce the time and cost of the creation or modification of a typical input deck. This data bank will be an invaluable tool in the timely investigation of recent and ongoing nuclear reactor safety analysis. This paper discusses the status and plans for the NPDB development and describes its anticipated structure and capabilities.

9191 **(LA-UR—86-3691) MELPROG/TRAC: update and applications.** Henninger, R.J.; Kelly, J.E. (Los Alamos National Lab., NM (USA); Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract W-7405-ENG-36. 25p. (CONF-8610135—31). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001984.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The first complete, coupled, and mechanistic analysis of a core meltdown sequence has been made with MELPROG-PWR/MOD1 and MELPROG/TRAC. The sequence analyzed was a station blackout accident for the Surry plant. Through vessel failure, all important aspects of the meltdown sequence were calculated. This version of MELPROG permits a full two-dimensional treatment of the in-vessel phenomena. Natural circulation can thus be modeled. Comparison to one-dimensional MELPROG and MARCH calculations shows that natural circulation reduces the rate of core heating, but increases the rate of heating of upper plenum structures and primary piping. This increased heating can inhibit fission product deposition and may lead to an early failure of the primary system. Because of uncertainty, sensitivity studies were performed to assess the relative importance of modeling assumptions. Changes in the modeling of the initial fuel rod melting and relocation were found to vary the hydrogen source by a factor of 2 and alter the timing of key events. These results imply that accurate and mechanistic modeling is important for severe accident sequence analysis.

9192 **(LA-UR—86-3692) Comparison of a TRAC calculation to the data from LSTF run SB-CL-05.** Motley, F.; Schultz, R. (Los Alamos National Lab., NM (USA); Idaho National Engineering Lab., Idaho Falls (USA)). 1986. Contract W-7405-ENG-36. 26p. (CONF-8610135—35). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001985.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Run SB-CL-05 is a 5% break in the side of the cold leg. The test results show that the core was uncovered briefly and that the rods overheated at certain core locations. Liquid holdup on the upflow side of the steam generator tubes was observed. When the loop seal cleared, the core refilled and the rods cooled. The TRAC results are in reasonable agreement with the test data, meaning that TRAC correctly predicted the major trends and phenomena. TRAC predicted the core uncovery, the resulting rod heatup, and the liquid holdup on the upflow side of the steam generator tubes correctly. The clearing of the loop seal allowed core recovery and cooled the overheated rods just as it had in the data, but TRAC predicted its occurrence 20 s late. The experimental and TRAC analysis results of run SB-CL-05 are similar to those for Semiscale Run S-UT-8. In both runs there was core uncovery, rod overheating, and steam generator liquid holdup. These results confirm scaling of these phenomena from Semiscale (1/1650) to LSTF (1/48).

9193 **(LA-UR—86-3693) Analysis results from the Los Alamos 2D/3D program.** Boyack, B.E.; Cappiello, M.W.; Stumpf, H.; Shire, P.; Gilbert, J.; Hedstrom, J. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 11p. (CONF-8610135—36). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001986.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Los Alamos National Laboratory is a participant in the 2D/3D program. Activities conducted at Los Alamos National Laboratory in support of 2D/3D program goals include analysis support of facility design, construction, and operation; provision of boundary and initial conditions for test facility operations based on analysis of pressurized water reactors; performance of pretest and posttest predictions and analyses; and use of experimental results to validate and assess the single- and multidimensional nonequilibrium features in the Transient Reactor Analysis Code (TRAC). During Fiscal Year 1986, Los Alamos conducted analytical assessment activities using data from the Cylindrical Core Test Facility and the Slab Core Test Facility. Los Alamos also continued to provide support analysis for the planning of Upper Plenum Test Facility experiments. Finally, Los Alamos either completed or is currently working on three areas of TRAC modeling improvement. In this paper, Los Alamos activities during Fiscal Year 1986 are summarized; several significant accomplishments are described in more detail to illustrate the work activities at Los Alamos.

9194 **(LA-UR—86-3694) TRAC code development status and plans.** Spore, J.W.; Liles, D.R.; Nelson, R.A.; Dotson, P.J.; Steinke, R.G.; Knight, T.D.; Henninger, R.J.; Martinez, V.; Jenks, R.P.; Cappiello, M.W. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 21p. (CONF-861035—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001987.

From 2. international meeting on simulation methods in nuclear engineering; Montreal, Canada (14 Oct 1986).

This report summarizes the characteristics and current status of the TRAC-PF1/MOD1 computer code. Recent error corrections and user-convenience features are described, and several user enhancements are identified. Current plans for the release of the TRAC-PF1/MOD2 computer code and some preliminary MOD2 results are presented. This new version of the TRAC code implements stability-enhancing two-step numerics into the 3-D vessel, using partial vectorization to obtain a code that has run 400% faster than the MOD1 code.

9195 **(LA-UR—86-3695) TRAC-PF1/MOD1 pretest predictions of MIST experiments.** Boyack, B.E.; Steiner, J.L.; Siebe, D.A. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 20p. (CONF-8610135—32). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001988.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Los Alamos National Laboratory is a participant in the Integral System Test (IST) program initiated in June 1983 to provide integral system test data on specific issues and phenomena relevant to post small-break loss-of-coolant accidents (SBLOCAs) in Babcock and Wilcox plant designs. The Multi-Loop Integral System Test (MIST) facility is the largest single component in the IST program. During Fiscal Year 1986, Los Alamos performed five MIST pretest analyses. The five experiments were chosen on the basis of their potential either to approach the facility limits or to challenge the predictive capability of the TRAC-PF1/MOD1 code. Three SBLOCA tests were examined which included nominal test conditions, throttled auxiliary feedwater and asymmetric steam-generator cooldown, and reduced high-pressure-injection (HPI) capacity, respectively. Also analyzed were two "feed-and-bleed" cooling tests with reduced HPI and delayed HPI initiation. Results of the tests showed that the MIST facility limits would not be approached in the five tests considered. Early comparisons with preliminary test data indicate that the TRAC-PF1/MOD1 code is correctly calculating the dominant phenomena occurring in the MIST facility during the tests. Posttest analyses are planned to provide a quantitative assessment of the code's ability to predict MIST transients.

9196 **(NUREG—1057-Suppl.3) Safety evaluation report related to the operation of Beaver Valley Power Station, Unit 2 (Docket No. 50-412).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1986. 40p. NTIS, PC A03/MF A01 - GPO. File Number TI87900170.

This report, Supplement No. 3 to the Safety Evaluation Report for the application filed by the Duquesne Light Company et al. (the applicant) for a license to operate the Beaver Valley Power Station, Unit 2 (Docket No. 50-412), has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the status of certain items that had not been resolved when the Safety Evaluation Report and its Supplements 1 and 2 were published.

9197 **(NUREG/CR—3963) Closeout of IE Bulletin 83-03: Check valve failures in raw water cooling systems of diesel generators.** Foley, W.J.; Dean, R.S.; Hennick, A. (Parameter, Inc., Elm Grove, WI (USA)). Nov 1986. 47p. NTIS, PC A03/MF A01 - GPO. File Number TI87900297.

On March 26, 1982, IE Information Notice 82-08 was issued by the NRC to alert utilities to the check valve failures on diesel generator cooling systems at Dresden Station. On March 10, 1983, IE Bulletin 83-03 was issued by the NRC to licensees of operating power facilities to report the failures at Dresden and similar failures at Quad Cities, and to require use of effective means for assuring the integrity of check valves in raw water cooling systems for diesel generators. In order to provide guidance for preparation of testing and inspection programs, the bulletin was issued for information to holders of construction permits. Because diesel generators are used to generate emergency power, this potential problem is safety-related. Evaluation of utility responses and NRC/IE inspection reports shows that the bulletin can be closed out for 69 (84%) of the 82 current operating facilities to which it was issued for action. Followup items for the remaining 13 facilities are proposed for use by the NRC/IE, to ensure satisfactory completion of corrective action. Remaining areas of concern are identified and conclusions are drawn.

9198 **(NUREG/CR—4306) Review and evaluation of spatial system interaction programs.** Harris, S.; Jones, M.; Prock, M.; Schneider, S.; Zaharoff, G. (Mark Technologies Corp., San Francisco, CA (USA)). Oct 1986. Contract AC05-84OR21400. 251p. (ORNL/Sub—84-17600/1). NTIS, PC A12/MF A01 - GPO. File Number TI87002282.

This report describes a project sponsored by the US Nuclear Regulatory Commission (NRC) Generic Issues Branch and performed by Mark Technologies Corporation under contract to Oak Ridge National Laboratory (ORNL). The project was to review the major system interaction (SI) programs conducted by the industry and summarize significant spatial interaction search methodologies and spatial interaction findings.

9199 (NUREG/CR—4512) **Pressurized melt ejection into scaled reactor cavities.** Tarbell, W.W.; Pilch, M.; Brockmann, J.E.; Ross, J.W.; Gilbert, D.W. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1986. Contract AC04-76DP00789. 185p. (SAND—86-0153). NTIS, PC A09/MF A01 - GPO. File Number TI87003237.

This report describes four tests performed in the High-Pressure Melt Streaming Program (HIPS) using linear-scaled cavities of the Zion Nuclear Power Plant. These experiments were conducted to study the phenomena involved in high-pressure ejection of core debris into the cavity beneath the reactor pressure vessel. One-tenth and one-twentieth linear scale models of reactor cavities were constructed and instrumented. The first test used an apparatus constructed of alumina firebrick to minimize the potential interaction between the ejected melt and cavity material. The remaining three experiments used scaled representations of the Zion nuclear plant geometry, constructed of prototypic concrete composition.

9200 (NUREG/CR—4537) **Electrical equipment performance under severe accident conditions (BWR/Mark 1 plant analysis): Summary report.** Bennett, P.R.; Kolaczkowski, A.M.; Medford, G.T. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1986. Contract AC04-76DP00789. 442p. (SAND—86-0451). NTIS, PC A19/MF A01 - GPO. File Number TI87003192.

The purpose of the Performance Evaluation of Electrical Equipment during Severe Accident States Program is to determine the performance of electrical equipment, important to safety, under severe accident conditions. In FY85, a method was devised to identify important electrical equipment and the severe accident environments in which the equipment was likely to fail. This method was used to evaluate the equipment and severe accident environments for Browns Ferry Unit 1, a BWR/Mark I. Following this work, a test plan was written in FY86 to experimentally determine the performance of one selected component to two severe accident environments.

9201 (NUREG/CR—4563) **Analysis of station blackout accidents for the Bellefonte pressurized water reactor.** Gasser, R.D.; Bieniarz, P.P.; Tills, J.L. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1986. Contract AC04-76DP00789. 135p. (SAND—86-0576). NTIS, PC A07/MF A01 - GPO. File Number TI87003019.

An analysis has been performed for the Bellefonte PWR Unit 1 to determine the containment loading and the radiological releases into the environment from a station blackout accident. A number of issues have been addressed in this analysis which include the effects of direct heating on containment loading, and the effects of fission product heating and natural convection on releases from the primary system. The results indicate that direct heating which involves more than about 50% of the core can fail the Bellefonte containment, but natural convection in the RCS may lead to overheating and failure of the primary system piping before core slump, thus, eliminating or mitigating direct heating. Releases from the primary system are significantly increased before vessel breach due to natural circulation and after vessel breach due to reevolution of retained fission products by fission product heating of RCS structures.

9202 (NUREG/CR—4630) **Analysis of counter-current adiabatic flow limitation phenomenon in vertical pipes.** Popov, N.K.; Rohatgi, U.S. (Brookhaven National Lab., Upton, NY (USA)). Sep 1986. Contract AC02-76CH00016. 87p. (BNL-NUREG—52012). NTIS, PC A05/MF A01 - GPO. File Number TI87001876.

This report presents the results of the analysis of the counter-current annular flow in a vertical pipe which consists of falling liquid film and upward gas flow. The major task was to compare the existing correlations for interfacial shear stress, entrainment inception and entrainment rate with the flooding data presently available. To this end a steady-state, adiabatic, one-dimensional, two-phase flow model has been developed. The formulation of the proposed model consists of a separated (or two fluid) flow analysis of liquid film and gas-droplet mixture; the droplets in the gas-droplet mixture in the pipe core have been treated by the drift-flux model. It was found that entrainment and interfacial shear correlations, originally developed for co-current flow, when applied to counter-current flow in this analysis, do not provide acceptable agreement with the data. Therefore, some modifications to those correlations to better predict the available counter-current data habe been suggested. Finally, the most recent released versions of TRAC-PF1 and RELAP5/MOD1 thermohydraulic codes were run and compared to the data for the case of counter-current flooding simulations. The results have shown that the codes are very conservative in counter-current flooding predictions. This was especially apparent for RELAP5/MOD1 which could not predict the University of Houston Flooding Tests. The test section had a thin film annular regime while the code assumed a droplet regime and so it was unable to predict the counter-current flow.

9203 (NUREG/CR—4697) **Chemistry and transport of iodine in containment.** Beahm, E.C.; Shockley, W.E.; Weber, C.F.; Wisbey, S.J.; Wang, Y.M. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 50p. (ORNL/TM—10135). NTIS, PC A03/MF A01 - GPO. File Number TI87000197.

The description of containment iodine behavior in reactor accident sequences involves a combination of iodine volatility effects, deposition/revaporization chemical reactions, and mass transport of iodine species. The experimental work in this program has largely centered on the interactions of iodine in, or with, water pools. The development of a model of iodine behavior, as presented here, begins with the identification of factors in the transport and chemistry of iodine and then proceeds with a description of the structure of the model.

9204 (ORNL—4169/V2/S2) **The Oak Ridge Research Reactor: safety analysis: Volume 2, supplement 2.** Hurt, S.S. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002978.

The Oak Ridge Research Reactor Safety Analysis was last updated via ORNL-4169, Vol. 2, Supplement 1, in May of 1978. Since that date, several changes have been effected through the change-memo system described below. While these changes have involved the cooling system, the electrical system, and the reactor instrumentation and controls, they have not, for the most part, presented new or unreviewed safety questions. However, some of the changes have been based on questions or recommendations stemming from safety reviews or from reactor events at other sites. This paper discusses those changes which were judged to be safety related and which include revisions to the syphon-break system and changes related to seismic considerations which were very recently completed. The maximum hypothetical accident postulated in the original safety analysis requires dynamic containment and filtered flow for compliance with 10CFR100 limits at the site boundary.

9205 (ORNL/TM—10045) **Common cause failure analysis of the rodded scram system of the Arkansas Nuclear One-Unit 1 Plant.** Montague, D.F.; Campbell, D.J.; Flanagan, G.F. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87001633.

This study demonstrates the use of a formal method for common cause failure analysis in a reliability analysis of the Arkansas Nuclear One - Unit 1 rodded scram system. The scram system failure of interest is loss of capability of the system to shut the reactor down when required. The results of this analysis support the ATWS program sponsored by the US Nuclear Regulatory Commission. The methods used in this analysis support the NRC's Risk Methods Integration and Evaluation Program (RMIEP).

9206 **(RIG—19) Examination of transport theoretic methods on the neutron flux and criticality determination for the accident of water ingress in gas-cooled pebble-bed reactors.** Schuerrer, F.; Ninaus, W.; Rabitsch, H.; Oswald, K.; Mueller, H.; Kreiner, H.; Neef, R.D. (Technische Univ., Graz (Austria). Reaktorinstitut; Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Apr 1986. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87700465.

The ingress of water into the core region represents relevant safety risk for gas-cooled high-temperature reactors. Neutron-physical aspects of this accident were studied at a high-temperature reactor cell driven by the annular core of an Argonaut-reactor. The experimental results were compared with calculated predictions using the GAMTEREX code. The comparison proves a satisfying conformity of calculated reactivities and neutron flux distributions with the corresponding results of measurement.

9207 **(SAND—86-1834C) MELCOR 1.5 calculations for ABCOVE aerosol experiments AB5, AB6, and AB7.** Leigh, C.D. (Sandia National Labs., Albuquerque, NM (USA)). 15 Jul 1986. Contract AC04-76DP00789. 14p. (CONF-8610166—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87000982.

From MELCOR user's meeting; Rockville, MD, USA (30 Oct 1986).

The MELCOR code was used to simulate the ABCOVE Aerosol experiments AB5, AB6, and AB7. In these tests, a dry sodium aerosol was introduced into an 850 m^3 vessel and the aerosol behavior was monitored. Single and double component aerosols were used. Other codes have been used to simulate these tests including the CONTAIN code at Sandia National Laboratories. Results from MELCOR were compared both to the experimental data and to the CONTAIN results. MELCOR results were nearly identical to the CONTAIN results. Code predictions for the suspended mass of aerosol track the experimental data to the end of the experiment to within a factor of two or three. Final predictions of the mass deposited by settling agree within an 11% error for all tests. In AB5, where the primary plating mechanism is thermophoresis, code predictions for the mass of material deposited by plating agree with the experimental data with a 12% error. However, when plating occurs by other mechanisms, for instance by inertial deposition or by diffusion, the codes do not give accurate results for the amount of material deposited on the walls at the end of the test.

9208 **(SAND—86-1950C) Sandia code accuracy quantification and its application to TRAC-PF1/MOD1 assessment.** Kmetyk, L.N.; Elrick, M.G.; Byers, R.K.; Buxton, L.D. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 44p. (CONF-8610135—34). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001740.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Code assessment is performed to obtain a judgment of the accuracy and validity of any given code over its range of applicability. To achieve this, the codes are exercised against a matrix of experiments, resulting in comparisons between code predictions and measured data. Thus far, conclusions on code accuracy drawn from previous independent assessment studies have appeared to be mostly phenomenological and/or qualitative. There is an increasing emphasis within the NRC code assessment effort to formulate more coherent, quantitative conclusions on the capabilities and accuracies of the codes. This can be done by using statistically-based methods to evaluate the overall accuracy of the codes with respect to particular key phenomena, based on the same code analyses of individual experiments. One possibility for a code accuracy quantification methodology is presented in this paper.

9209 **(SAND—86-1989C) Development and applications of the interim direct heating model for the CONTAIN computer code.** Bergeron, K.D.; Carroll, D.E.; Tills, J.L.; Washington, K.E.; Williams, D.C. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1986. Contract AC04-76DP00789. 23p. (CONF-8610135—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002702.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

A model for Direct Containment Heating has been developed for the CONTAIN code which takes account of the competing processes of melt ejection, steam blowdown, heat transfer among debris, gas and walls, chemical reactions in the debris droplets, intercell gas and debris transport, and de-entrainment of the suspended debris. Calculations of accident sequences with the model have shown that a qualitatively different understanding of the Direct Heating phenomenon emerges when more detailed multi-cell calculations are preformed within a system-level containment code, compared to the relatively simplistic single cell, adiabatic calculations which have been used in the past. Results are presented for the TMLB' sequence at the Surry and Sequoyah plants, and a sensitivity study for some of the most important uncertain parameters is described.

9210 **(SAND—86-2220C) DCH-1: The first direct containment heating experiment in the SURTSEY Test Facility.** Tarbell, W.W.; Brockmann, J.E.; Pilch, M. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 25p. (CONF-8610135—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001732.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The DCH-1 test was the first experiment performed in the SURTSEY Direct Heating Test Facility. It was designed to provide the experimental data required to understand the phenomena associated with pressurized melt ejection and direct containment heating. The results will be to develop phenomenological models for large containment response codes. The test involved 20 kg of molten core debris simulant ejected into a 1:10 scale mockup of the Zion reactor cavity. The melt was produced by a metallothermitic reaction of iron oxide and aluminum powders to yield molten iron and alumina. The cavity model was placed so that the emerging debris would propagate directly upwards along the vertical centerline of the chamber. Results from the experiment showed that the dispersed debris caused a rapid pressurization of the chamber atmosphere. Peak pressure from the six transducers ranged from 0.9 to 0.13 MPa (13.4 to 19.4 psig). The time interval from the start of debris ejection to pressure peak was two to three seconds. Post-test debris collection yielded 11.6 kg of material outside the cavity, of which approximately 1.6 kg was attributed to the uptake of oxygen by the iron particles. Mechanical sieving of the recovered debris showed a log-normal size distribution with a mass mean size of 0.55 mm. Aerosol measurements indicated a substantial portion (~ 5 to 29%) of the displaced mass was in the size range less than 10 μm.

9211 **(SAND—86-2464C) Calculations of containment loading due to high pressure ejection of core debris.** Gasser, R.D.; Carroll, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 28p. (CONF-8610135—29). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001736.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The direct containment heating (DCH) issue has surfaced in the past year or two as one of the major factors affecting the risk uncertainty for pressurized water reactors in general. As a result, work has been progressing at Sandia on several aspects of the DCH issue, both from an experimental and an analytical standpoint, with a view to developing more advanced analytical capabilities for treating the rather complex phenomenology involved. This paper is intended to describe Sandia's contributions to the analyses of direct containment heating that were performed under the auspices of the SASA and QUECLA programs. The SASA program effort involved application of newly developed DCH models in the CONTAIN code to hypothetical high pressure ejection scenarios in the Surry and Bellefonte nuclear power plants.

9212 **(SAND—86-2520C) Accident characterization methodology.** Camp, A.L.; Harper, F.T. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 15p. (CONF-8610135—37). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001729.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Nuclear Regulatory Commission (NRC) is preparing NUREG-1150 to examine the risk from a selected group of nuclear power plants. NUREG-1150 will provide technical bases for comparison of NRC research to industry results and resolution of numerous severe accident issues. In support of NUREG-1150, Sandia National Laboratories has directed the production of Level 3 Probabilistic Risk Assessments (PRAs) for the Surry, Sequoyah, Peach Bottom, and Grand Gulf nuclear power plants. The Accident Sequence Evaluation Program (ASEP) at Sandia has been responsible for the Level 1 portion of the analyses, which includes estimation of core damage frequency and characterization of the dominant sequences. The ASEP analyses are being documented in NUREG/CR-4550. The purpose of this paper is to briefly describe and evaluate the methodology utilized in these analyses. The methodology will soon be published in more detail as Reference 5. The results produced for NUREG/CR-4550 using this methodology are summarized in another paper to be presented at this conference.

9213 **(SAND—86-2521C) Results of core damage frequency analysis for the reference plants.** Harper, F.T.; Bertucio, R.C.; Drouin, M.T.; Kolaczkowski, A.M.; Wheeler, T.A. (Sandia National Labs., Albuquerque, NM (USA); Energy, Inc., Kent, WA (USA); Science Applications International Corp., La Jolla, CA (USA)). 1986. Contract AC04-76DP00789. 21p. (CONF-8610135—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002054.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Nuclear Regulatory Commission (NRC) is preparing NUREG-1150 to examine risk from a selected group of nuclear power plants. NUREG-1150 will provide a basis for comparison of NRC research to industry results and resolution of numerous severe accident issues. In support of NUREG-1150, Sandia National Laboratories has directed the production of NUREG/CR-4550. NUREG/CR-4550 includes Level 1 Probabilistic Risk Assessments (PRAs) for the Surry, Sequoyah, Peach Bottom, and Grand Gulf nuclear power plants and a limited reanalysis of the Zion PRA. A brief summary of the current results of these five analyses will be presented in this paper. A paper describing and evaluating the methodology used to perform the four Level 1 PRAs will also be presented at this conference.

9214 **(SAND—86-2547C) Risk and risk reduction results for Surry, obtained in support of NUREG-1150.** Benjamin, A.S.; Boyd, G.J. (Sandia National Labs., Albuquerque, NM (USA); Safety and Reliability Optimization Services, Knoxville, TN (USA)). 1986. Contract AC04-76DP00789. 33p. (CONF-8610135—20). NTIS, PC A03/MF A01; GPO Dep. File Number DE87002056.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The Severe Accident Risk Rebaselining/Risk Reduction Program has completed a rebaselining of the risks to the public from a particular pressurized water reactor with a subatmospheric containment (Surry, Unit 1). Emphasis was placed on determining the magnitude and character of the uncertainties, rather than focusing on a point estimate. The risk reduction potential of a set of proposed safety option backfits was also studied, and their costs and benefits were evaluated. It was found that the risks from internal events are generally lower than previously evaluated in the Reactor Safety Study (RSS). However, certain unresolved issues (such as direct containment heating) cause the top of the uncertainty band to appear at a level that is comparable with the RSS point estimate. None of the postulated safety options appears to be cost-effective for the Surry power plant.

9215 **(SAND—86-2562C) Influence of chemical form on cesium revaporization from the reactor coolant system.** Powers, D.A.; Bieniarz, P.P. (Sandia National Labs., Albuquerque, NM (USA); Risk Management Associates, Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 12p. (CONF-860911—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002485.

From 192. American Chemical Society national meeting; Anaheim, CA, USA (7 Sep 1986).

The issue of revaporization of deposited radionuclides during severe reactor accidents is discussed. Thermodynamic properties are estimated for the mixtures $CsOH + CsI$, $CsBO_2 + B_2O_3$, and $Cs_2SiO_3 + SiO_2$. It is shown that the chemical form of deposited cesium can alter the rate and timing of revaporization.

9216 **(STUK-B-VALO—45) 2. interim report on radiation situation in Finland from 5 to 16 May 1986.** (Finnish Centre for Radiation and Nuclear Safety, Helsinki). May 1986. 50p. Saeteilyturvakeskus, Helsinki, Finland.

Prepared by Finnish Centre for Radiation and Nuclear Safety, NBC Defence Office of the General Headquarters and Rescue Department of the Ministry of the Interior.

This second interim report is a continuation of the first 'Fallout situation in Finland from April 26 to May 4' STUK-B-VALO-44. It deals with the results from external radiation measurements and analysis of environmental and foodstuff samples between 5 and 16 May, i.e. the development of the situation after the fallout peak. The whole-body counter measurements of tourists returning from the Soviet Union and from other countries in Eastern Europe after the accident are also reported.

9217 **(VTT-TIED—581) Radioactivity size distributions of ambient aerosols in Helsinki, Finland during May 1986 after Chernobyl accident. Discussions of accident scenario. Preliminary report.** Kauppinen, E.; Hillamo, R.; Jokiniemi, J.; Aaltonen, H.; Sinkko, K. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jun 1986. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750402.

Ambient aerosol size distributions of ^{131}I, ^{103}Ru, ^{132}Te and ^{137}Cs radionuclides were measured in Helsinki, Finland during May 7-14, 1986. Radioactivity size distributions were unimodal. Geometric mean diameter of ^{131}I was in the size range 0.33 - 0.57 μm a.e.d. Other isotopes had geometric mean diameters in the size range 0.65 - 0.93 μm a.e.d.

9218 **On the excitation of neutron flux waves in reactor core transients.** Difilippo, F.C.; Perez, R.B. (Oak Ridge National Lab., P.O. Box X Oak Ridge, TN 37831). *Nuclear Science and Engineering;* **94**: No. 1, 66-69(Sep 1986).

The time response of a critical reactor to a perturbation in the cross sections has been analyzed in terms of the Green's function of the system. In this way it is possible to visualize the perturbation as a source of neutron waves that are reflected at the boundaries of the system. The original and reflected waves could, in principle, interfere with each other in producing resonances in response to the system; nevertheless, the damping of the neutron waves is usually so large that no dominant frequencies appear. Any observed resonant behavior of the neutron flux has then to be produced by a resonance in the perturbation.

25 ENERGY STORAGE

2506 Thermal

REFER ALSO TO CITATION(S) 9079

9219 **(BMFT-FB-T—86-066) Measuring program to investigate the thermal behavior of a 2000 m/sup 3/ heat storage tank. Final report.** Fritzsche, V. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1986. 208p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE87750789.

The objective of this project is to experience the thermal behavior of a heat storage tank with 2000 m/sup 3/ integrated in a district heating system. The grade of the temperature stratification, the energetic losses and the functionality of the load-changing utility are to be found. Realistic data gained by experiments are selected to calculate the economics of the heat storage tank. At the Institut fuer Kernenergetik und Energiesysteme, division Heizung-Lueftung-Klimatechnik, a computer model for the storage simulation is developed. The model has to be fed by measured data of the heat storage tank to judge the validity. In several experiments the influence of the load changing utility and the load volume flow on the formation of the gradient zone is investigated. Temperature gradients of 65 K/m and a thickness of the gradient zone of 1 m is measured. The heat losses at inactive state are determined. The average heat losses of the storage tank are to 3.2 GJ/day at a stored energy of 335 GJ. It is found, that the gradient zone is not changed significantly during an experimental time over more than 1054 hours. The results of the calculations with the computer model show good agreement with measured data. When judging the economics it is shown, that the return flux of capital for the heat storage tank is about 2.4 years. With 58 refs., 4 tabs., 104 figs.

9220 **(N—86-31982) Estimated heats of fusion of fluoride salt mixtures suitable for thermal energy storage applications.** Misra, A.K.; Whittenberger, J.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). May 1986. 26p. (NASA-TM—87320; E—3057; NAS—1.15:87320). NTIS HC A03/MF A01.

The heats of fusion of several fluoride salt mixtures with melting points greater than 973 K were estimated from a coupled analysis of the available thermodynamic data and phase diagrams. Simple binary eutectic systems with and without terminal solid solutions, binary eutectics with congruent melting intermediate phases, and ternary eutectic systems were considered. Several combinations of salts were identified, most notable the eutectics LiF-22CaF$_2$ and NaF-60MgF$_2$ which melt at 1039 and 1273 K respectively which posses relatively high heats of fusion/gm (greater than 0.7 kJ/g). Such systems would seemingly be ideal candidates for the light weight, high energy storage media required by the thermal energy storage unit in advanced solar dynamic power systems envisioned for the future space missions.

2509 Batteries

9221 **(EUR—9261) Improvement of manufacture, lifespan, performance and safety of sodium-sulfur cells designed for storage of electric energy.** Jacquelin, J.; Gadessaud, R.; Duperray, G.; Gay, D. (Commission of the European Communities, Luxembourg). 1984. 92p. (In French). Commission of the European Communities, Luxembourg.

Changes were made to five aspects of the process for making electrolyte tubes. Improvements to the process for producing β'' alumina led to an increase in electrochemical performances and durability in sodium-sulfur cells. As a result of materials research, electrolytic iron and ex-carbonyl nickel powders were chosen for sodium wicks on account of wetting properties and costs. Their behaviour was tested in small standard sodium-sulfur cells, but with two different technologies for the sodium compartment: 1) a lateral wick; 2) the wick located in a central position for transferring sodium from the reservoir to the inside surface of the electrolyte. The first cycles were operated with normal position of the cells and the following cycles with cells upside down. Best results were obtained with a central wick for 105 cycles. A new technology was studied using injection of a preimpregnated wick. Results were promising, but the manufacturing process has to be improved. Some large cells were fitted with sodium wicks: results were good for the first cycle only. Preimpregnated wicks will be used for future development.

9222 **(EUR—9405) Study of new solid electrolytes and associated cathodes. Study and realisation of new "all solid" generators.** Levasseur, A.; Delmas, C. (Commission of the European Communities, Luxembourg). 1984. 77p. (In French). Commission of the European Communities, Luxembourg.

The use of "all solid" secondary generators functioning at environmental temperature calls for the use of a solid electrolyte with high ionic conductivity, negligible electronic conductivity, and chemically and electronically stable vis-a-vis the electrodes. This generator must also tolerate a positive electrode material with considerable mass energy. A major part of this study is directed towards obtaining materials with these qualities. Crystalline and vitrous materials were studied for the electrolyte. The low conductivity obtained in the first case led to a concentration of effort on numerous groups of amorphous materials with borate and lithium chalcoborate bases (sodium glasses have a lower systematic conductivity than glasses containing lithium). Work has been conducted simultaneously on intercalation compounds of type Asub(x)MO$_2$(A=Li, Na; M=element 3d) which may be suitable for use as the material for the positive electrode.

9223 **(LBL—20659) The Li/Li$_3$N electrode: Study of its electrochemical behavior in an organic electrolyte by electrode-impedance spectroscopy.** Thevenin, J.G.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC03-76SF00098. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003632.

Lithium nitride has been studied as a possible solid-electrolyte interphase between the lithium electrode and an organic electrolyte. The Li/Li$_3$N electrode has been obtained by exposing lithium to a pure nitrogen atmosphere at ambient temperature. This formation is found to result in a porous lithium nitride film, associated with a decrease in the molar volume during the reaction. The impedance behavior of the Li/Li$_3$N electrode can be interpreted by a porous-film model deduced from a transmission-line model. The slow filling of the micropores of the film and reaction of the lithium with electrolyte at the pore bottom are responsible for changes of impedance and open circuit potential with time and under cycling.

9224 **(LBL—20660) Study of the impedance behavior of surface layers formed on lithium electrodes in a propylene carbonate electrolyte.** Thevenin, J.G.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC03-76SF00098. 140p. NTIS, PC A07/MF A01; GPO Dep. File Number DE87003631.

Different models of homogeneous and heterogeneous interphases have been investigated for the interpretation of impedance measurements of surface layers formed on lithium electrodes in an organic electrolyte. These models are based on the assumption that the surface layer consists of organic and inorganic compounds with the properties of solid and polymer electrolytes. The models discussed are compact, porous and multilayer systems. The analysis of the models is derived from a study of the equivalent circuits and the corresponding impedance diagrams for the different interphase models. This analysis leads to the determination of impedance parameters for the evaluation of the thickness of surface layers. The impedance measurements for lithium in propylene carbonate lithium perchlorate solution can be fitted by two interphase models. (1) The surface layer can be assumed to consist of two sublayers of different permittivities and conductivities according to the Compact-Stratified Layer (CSL) Model. (2) The surface layer can also be assumed to consist of a mixture of solid and polymer electrolytes according to the Solid-Polymer Interphase (SPI) Model. The thickness of surface layers deduced from the impedance data appears in agreement with the thicknesses which have been obtained by ellipsometric measurements in previous work.

9225 **Low shear nickel electrode.** Fritts, D.H.; Leonard, J.F. (to Secretary of the Air Force, Washington, DC). US Patent 4,623,600. 18 Nov 1986. Filed date 23 Aug 1985. v.p.

This patent describes a battery plaque consisting essentially of a centrally located layer of a conductive felt having a layer of sintered metal powder on each side thereof. The sintered metal layers do not connect through the felt layer and there is substantially no attachment of the metal powder particles in the sintered layers to the strands in the felt layer, thereby allowing a degree of slippage between the felt layer and the sintered layers.

9226 **Double-grooved gasket for galvanic cells.** Vourlis, H. (to Union Carbide Corp., Danbury, CT). US Patent 4,623,599. 18 Nov 1986. Filed date 27 Jun 1985. v.p.

This patent describes a galvanic cell having an anode, an electrolyte and a cathode assembled in a sealed cell housing, the housing comprising, (a) a first cover member having at least one dependent skirt; (b) a second cover member having at least one dependent skirt; (c) an electrically non-conductive gasket having a central opening, an upper surface with a groove disposed in the upper surface, and an inner wall inward of the upper and lower surface grooves defining the central opening. The dependent skirt of the first cover member is positioned in the groove in the lower surface of the gasket. The dependent skirt of the second cover member is positioned in the groove in the upper surface of the gasket and, the inner wall of the gasket contacts interior portions of both of the cover members and having a height equal to the distance between the cover members in the interior of the cell housing.

9227 **Rechargeable battery and electrode used therein.** Sapru, K.; Reichman, B.; Reger, A.; Ovshinsky, S.R. (to Energy Conversion Devices, Inc., Troy, MI). US Patent 4,623,597. 18 Nov 1986. Filed date 25 Nov 1985. v.p.

This patent describes a hydrogen battery comprising: at least one anode for reversibly electrochemically charging and discharging hydrogen, the anode comprising a disordered multicomponent material. The disordered multicomponent material has at least one structure selected from the group consisting of: amorphous, microcrystalline, polycrystalline lacking long-range compositional order with three or more phases of the polycrystalline, structure and any combination of the amorphous, microcrystalline and polycrystalline structures; a casing having the anode positioned therein; at least one cathode capable of reversible oxidation positioned within the casing and spaced from the anode; a separator separating the cathode and the anode; and an electrolyte in contact with both the cathode and the anode.

9228 **Voltammetry of lithium polysulfides at metal electrodes.** Dobson, J.C.; McLarnon, F.R.; Cairns, E.J. (Applied Science Div., Lawrence Berkeley Lab., and Chemical Engineering Dept., Univ. of California, Berkeley, CA 94720). *Journal of the Electrochemical Society;* 133: No. 8, 1549-1554(Aug 1986). Contract AC03-76SF00098.

The interaction of lithium polysulfides and metals which have shown promise for use a current collector/cell casing materials for lithium/sulfur cells is explored using cyclic voltammetry. The metals used were chromium and molybdenum, and data for 10-500 mV/s potential sweeps at 400°C in Li/sub 2/S/sub 3.80/ are reported. The data were collected using an electrochemical cell designed specifically for this purpose. The results were analyzed using classical equations governing cyclic voltammetry, and a model was developed to describe specific melt-metal interactions.

9229 **Solid electrolytes: Problems and solutions.** DeJonghe, L.C. (Lawrence Berkeley Lab., Materials and Molecular Research Div., Berkeley, CA 94720). *American Ceramic Society Bulletin;* **65**: No. 8, 1158-1160(Aug 1986). Contract AC03-76SF00098.

Degradation phenomena occurring in sodium β''-alumina solid electrolytes as a consequence of their use in sodium/sulfur batteries are reviewed. Four classes of degradation are discussed: electrolyte reduction, crack propagation, internal sodium precipitation, and reaction with the polysulfide electrode. While degradation reactions may adversely affect cell life, it has been found that these deleterious effects may be avoided by impurity control of the system and by microstructural modification of the ceramic, including grain size control and zirconia-dispersion toughening.

9230 **Separator technology for electrochemical applications: Department of Energy-sponsored research.** Kinoshita, K. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). pp 403-410 of New materials and new processes:Volume 3. Cleveland, OH; JEC Press, Inc. (1985).

The Lawrence Berkeley Laboratory (LBL) is the Lead Center for management of the Technology Base Research (TBR) Project, which is supported by the Office of Energy Systems Research, Energy Storage Division of the U.S. Department of Energy (DOE). The purpose of this project is to provide the research base which supports DOE efforts to develop electrochemical technology for electric vehicle and stationary energy storage applications. Of the numerous research programs that are supported by the TBR project, many programs are directly involved with research and development of improved separators for batteries and other electrochemical systems. In addition, several of the programs are directed at investigating the electrochemical and physiochemical properties of available separators and electrolytes. A brief description of these programs on separator research is presented.

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 9882

9231 **(Juel—2049) Remarks to a process-overlapping description of cost structures of energy conversion processes.** Barnert, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Mar 1986. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750333.

The cost of energy conversion processes are more and more determined by capital expenses. These are partly used to improve the efficiency. With a mathematical formula for the relation between capital costs and efficiency a process-over-laping description is proposed and proved at 10 typically chosen energy conversion processes. The result is a classification of enery conversion processes in categories of efficiency-producing and efficiency-independent capital expenditures. Another result is that process-overlapping the relative capital cost supplement is described by the (1-eta)/eta-law.

9232 **(PNL-SA—13506) Energy policy analyses on a personal computer.** Roop, J.M.; Belzer, D.B. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 10p. (CONF-8604185—2). NTIS, PC A02. File Number DE87002714.

From 2. symposium on analytic techniques for energy, natural resources, and environmental planning; Philadelphia, PA, USA (3 Apr 1986).

An energy policy analysis tool for the personal computer has been developed, called the Sectoral Energy Analysis and Data System (SEADS-PC). The software package requires that the policy under investigation be translated into: changes in components of Gross National Product; a change in industry final demand; or a change in energy intensity in specific industries. SEADS-PC then converts these policy implications into changes in energy use in the US economy. These changes are analyzed through an input-output representation of the US economy that includes over 100 industries. An application of SEADS-PC to the energy consequences of balancing the federal budget suggests that the energy effects would be slight, but that petroleum use would increase relatively more than other fuels. A second application shows that as a result of petroleum intensity declines over the period 1972-1981, the economy used 4.6 quad (51.4%) less oil in 1981.

9233 **(UCID—18991-85) California energy flow in 1985.** Borg, I.Y.; Briggs, C.K. (Lawrence Livermore National Lab., CA (USA)). 5 Dec 1986. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003603.

Energy use in California in 1985 increased 4.8% as compared to a 1.4% increase in the nation as a whole. A part of the increase can be traced to increase in population which is estimated to have been 2%. Total energy consumption in the state reached the level of the peak year of 1979. The increase is associated with greater use of natural gas in all end-use sectors, which resulted in increased reliance on imported gas from Canada. The transportation end-use sector, which accounts for 37% of all consumed energy in the state, fell slightly from 1984 levels due to lower sales of bunkering fuels; the drop more than compensated for an increased consumption of motor gasoline and aviation fuels. California crude oil production was at an all time high due to expansion of steam and hot water flooding. The nuclear contribution to electrical power production increased. Imported power from out-of-state hydroelectric and coal-fired plants is the largest source of power to the state. Cogeneration and self generation pose problems for both the utilities and regulators as the rapid growth rate complicates planning and rate making. Together these two contributions to the electrical sector equate to about 4.5% of transmitted power. Alternate energy forms such as geothemal and windpower continued to grow; however it is uncertain whether the growth in windpower will continue as federal tax incentives expired at the end of the year. In addition environmental objections to wind installations began to surface in the southern part of the state.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 8867, 9042, 9275, 9316, 10595, 10596

9234 (ANL/EES-TM—303) **Disaggregation of industrial fossil fuel use in the 1985 National Energy Policy Plan: Methodology and results.** Boyd, G.A.; Ross, M.H.; Macal, C.M.; Hanson, D.A.; South, D.W. (Argonne National Lab., IL (USA)). Jan 1986. Contract W-31-109-ENG-38. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003645.

The methodology described here projects use of purchased boiler fuel from 1980 to 2030 for six industrial groups. Three types of information were required to generate these projections: a long-term forecast of total industrial fossil fuel use, forecasts of industrial activity, and relative growth rates of industrial energy intensity. The resulting projections were used as inputs to the Industrial Combustion Emissions (ICE) model, one of the sector models of the National Acid Precipitation Assessment Program. In our projections, we used long-term forecasts of fossil fuel use from the 1985 National Energy Policy Plan (NEPP) prepared by the US Department of Energy (DOE). The NEPP provides projections of total industrial energy use from 1980 to 2010 for several fuel types and three economic growth scenarios (base, low, and high). To extend these projections to 2030, total energy use, electricity use, and renewable energy use were extrapolated. We constructed relative rates of growth for energy intensity in each industry group from historical data. Combining the three elements - fossil fuel use, industrial activity, and relative growth rate of energy intensity - yields a disaggregation of total purchased fossil fuel for each industry consistent with the NEPP forecast. Total fossil fuel use is then converted to boiler fuel use by applying some conversion factors constructed from 1980 census data and 1980 ICE model data. The results indicate negligible growth in boiler fuel use for most of the six industries represented in detail in the ICE model. Only the chemical industry has any significant growth in boiler fuel use in the base and high cases. This finding reflects the low growth in fossil fuel use projected by the NEPP, optimistic projections for the chemical industry by DRI, and significant conservation rates in the other industries.

9235 (INIS-XN—53) **Projected costs of generating electricity from nuclear and coal-fired power stations for commissioning in 1995. A report by an Expert group.** (Nuclear Energy Agency, 75 - Paris (France)). 1986. 73p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87750723.

This report updates and extends the previous NEA study, "The Costs of Generating Electricity in Nuclear and Coal-fired Power Stations", published by the OECD in late 1983. Despite the changed expectations concerning coal prices and the considerable movements in exchange rates since the first study was completed, the conclusions remain essentially the same. Nuclear Power is projected to be economically superior by a significant margin to coal-fired plants for base load electricity production in Europe, Japan and some regions of North America. In areas of North America in close proximity to supplies of cheap coal, this would be the more economic fuel, unless future nuclear investment costs can be reduced to match the best US and Canadian experience. In all regions considered, the economic advantage of both coal and nuclear over oil and gas-fired plants for commissioning in the mid-1990s is expected to be substantial. These conclusions are based on an analysis of cost projections for 900 MWe to 1400 MWe Light Water Reactors to be commissioned in 1995, operating at a levelised load factor of about 72 per cent over an assumed 25 years economic life and calculated with a 5 per cent (real) discount rate. This parallels the reference reactor selected for the NEA report "The Economics of the Nuclear Fuel Cycle", which was published by the OECD in June 1985, though it deviates somewhat from the reference conditions of the previous generation cost study. Contemporary coal-fired stations ranging in capacity from 330 MWe to 700 MWe with the same assumed economic life and load factor provide the basis for comparison. Some data are included on CANDU Pressurised Heavy Water Reactors, and a brief comment is annexed on the relevance of the comparisons for the smaller plants that may be of interest to countries with smaller electricity networks or where special circumstances apply.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 9234, 9900, 9908, 10003, 10006, 10007

9236 (AD-A—172425/1/XAB) **Research and development of hazardous/toxic-waste analytical screening procedures: available field methods for rapid screening of hazardous-waste materials at waste sites. Annual report.** Snyder, R.E.; Schulte, B.E.; Mangoba; McHale, E.T. (Atlantic Research Corp., Alexandria, VA (USA)). Jan 1982. 413p. NTIS, PC A18/MF A01.

A literature survey was undertaken to identify very toxic substances that are potentially present at waste sites. The ten substances that presented the most-imminent hazard to workers at waste sites were selected and a list of candidate analytical field-screening methods for each substance prepared. The literature obtained on each candidate method was judged by the following criteria: method complexity, reagent cost and reagent toxicity. Candidate field-screening procedures were found for acrolein, carbon disulfide, carbonyl fluoride, chloropicrin, ethyleneimine, fluorine, hydrogen selenide, methylhydrazine, methyl isocyanate, and nickel carbonyl.

9237 (CONF-8512105—, pp 47-51) **Pollution cadastre as a means in future land-use planning.** Spitzauer, P.; Weiss, U. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Guaranteeing the quality of our natural resources of soil, water and air as well as preserving their ability to regenerate themselves are the most important aims of future landuse planning. First steps in this direction can be seen in the specification of extensively polluted areas for monitoring programs on the one hand and specification of compensating areas up to the level of biosphere reserves on the other. The future definition of these areas has to be oriented on results of natural science, especially those newer results of ecological chemistry which pertain to the emission of pollutants and their dispersion and deposition. Above all, the effects of pollutants on organisms and soil have to be taken into consideration. Pilot studies in polluted areas in Bavaria have led to new techniques for evaluating the present burden of ecotoxic substances. Residue analysis in plants and animals characterizes the contamination of agricultural products and indicates local risk factors, thereby suggesting improvements in present land use.

9238 (IIUG-pre—85-4) **History of environmental policy in Japan.** Tsuru, Shigeto. (Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). 1985. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750811.

For several decades the Japanese Government had adhered to its policy of promoting economic growth, more or less ignoring the disastrous repercussions on health and the environment. The unrestricted emission of pollutants had caused many severe injuries to health and even fatal diseases. It was not until protests against extreme environmental pollution had taken a nationwide dimension and some epochal lawsuits had been decided against industrial polluters that the Japanese Government responded with more effective environmental policy measures. By the mid-seventies, Japan - as compared to other countries - had become a pace-setter in environmental policy. Nevertheless, many unsolved problems have remained, and, moreover, Government's commitment to environmental issues has slackened noticeably. This article provides an overview over the development of Japanese environmental policy and describes some pivotal cases of conflict and other incidents that have decisively influenced this policy area.

2904 Natural Resources

REFER ALSO TO CITATION(S) 9264

9239 **(EPRI-EA—4871) EPRI [Electric Power Research Institute] water supply computerized information directory: Final report.** (Arizona Univ., Tucson (USA). Dept. of Management Information Systems). Nov 1986. 163p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920118.

This report describes the work which led to the design and implementation of the EPRI Water Supply Computerized Information Directory (WSCID). Development of the EPRI WSCID was motivated by the expressed difficulties of obtaining pertinent water supply information from the vast but extremely decentralized existing data covering the natural, technical, economic and legal aspects of water supply use and planning. The EPRI WSCID is an intricately structured directory of water supply organizations, data bases, documents and studies. As a central reference to these sources, the WSCID can greatly expedite the search for information needed to solve particular water supply problems. The practical capabilities of the system were tested by simulating a siting study previously conducted by the Los Angeles Department of Water and Power. The WSCID was used to locate and identify all the available sources of water supply data relevant to a proposed power plant to be built in White Pine County, Nevada.

9240 **(NP—7750806) Appropriation of common access natural resources through exploration: A differential game of a claiming rush.** Mohr, E. (Konstanz Univ. (Germany, F.R.). Fakultaet fuer Wirtschaftswissenschaften und Statistik). Oct 1985. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750806.

This paper provides a model of natural resource exploration, where the sole motivation to explore arises from a strategic incentive to preempt competitors. It is assumed that private ownership rights over a finite unexplored and commonly held resource stock can be established through a costly deterministic exploration process. The open-loop and the feedback Nash equilibrium is analysed. It is shown that in between intervals of soaring exploratory activities there may be an interval where exploration is declining over time.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 9515, 10007, 10637

9241 **(ANL/EES-TM—315) An evaluation of market penetration forecasting methodologies for new residential and commercial energy technologies.** Raju, P.S.; Teotia, A.P.S. (Argonne National Lab., IL (USA)). May 1985. Contract W-31-109-ENG-38. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003628.

Forecasting market penetration is an essential step in the development and assessment of new technologies. This report reviews several methodologies that are available for market penetration forecasting. The primary objective of this report is to help entrepreneurs understand these methodologies and aid in the selection of one or more of them for application to a particular new technology. This report also illustrates the application of these methodologies, using examples of new technologies, such as the heat pump, drawn from the residential and commercial sector. The report concludes with a brief discussion of some considerations in selecting a forecasting methodology for a particular situation. It must be emphasized that the objective of this report is not to construct a specific market penetration model for new technologies but only to provide a comparative evaluation of methodologies that would be useful to an entrepreneur who is unfamiliar with the range of techniques available. The specific methodologies considered in this report are as follows: subjective estimation methods, market surveys, historical analogy models, time series models, econometric models, diffusion models, economic cost models, and discrete choice models. In addition to these individual methodologies, which range from the very simple to the very complex, two combination approaches are also briefly discussed: (1) the economic cost model combined with the diffusion model and (2) the discrete choice model combined with the diffusion model. This discussion of combination methodologies is not meant to be exhaustive. Rather, it is intended merely to show that many methodologies often can complement each other. A combination of two or more different approaches may be better than a single methodology alone.

9242 **(DOE/ER—0305) Capsule review of DOE research and development and field facilities.** (USDOE Office of Energy Research, Washington, DC. Office of Field Operations Management). Sep 1986. 118p. H. File Number TI87003384.

This report provides an overview of the unique complex of research, technical development, manufacturing and administrative facilities that comprise the Department of Energy field installations. Facilities are located in almost all states of the Union. The FY 1986 budget for the entire complex was over $10 billion, excluding the Strategic Petroleum Reserve and the Power Marketing Administrations. There are approximately 135,000 employees working within the complex. Approximately 5% of these are federal employees; the remainder are employed and managed under contracts with industry and universities. The replacement cost of all field facilities would total well over $50 billion. Appendices include: list of DOE R and D and field facilities; address listing by type of laboratory or facility (includes telephone numbers); DOE research and development and field facilities employees by occupational field; and DOE research and development and field facilities employees by academic degree.

9243 **(EGG-M—32886) Technology transfer initiatives in Idaho National Lab/incubators.** Warner, B.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 5 Sep 1986. Contract AC07-76ID01570. 13p. (CONF-8609202—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002596.

From Focus '86 (technology transfer); Albuquerque, NM, USA (9 Sep 1986).

This paper discusses how some of the things learned from others have been applied in Idaho National Engineering Laboratory initiatives with the State of Idaho. Discussed also is a new approach to a technology transfer communication vehicle.

9244 **(GSO—1985-0096) National Geoscience Programme. Progress Reports 1984.** (Department of Mineral and Energy Affairs, Pretoria (South Africa). Geological Survey). 1985. 298p. (In English and Afrikaans). Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

This volume contains the annual progress reports on research projects supported by the National Geoscience Programme in 1984. This work includes reports on geology, geochemistry, mineralization, isotopic studies, radiometric surveys, geochronology, petrology, lithology, sedimentology and metamorphism. Materials involved are galena, magma, igneous rocks, sulfides, magnetite, vanadium, zirconium, strontium, lead, samarium, neodymium, niobium, carbon, gold, uranium, nickel, chromium, sillimanite, platinum and thorium to name a few. Techniques used are x-ray fluorescence analysis, x-ray diffraction, scanning electron microscopy, electron diffraction, neutron activation analysis, electron microprobe analysis and isotopic studies. Forty six summaries of projects undertaken, are compiled in this National Geoscience Programme.

9245 (KURRI-TR—250) **Summary reports of activities under visiting research program. First half of 1983.** (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1984. 63p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700313.

Technical Report of the Research Reactor Institute, Kyoto University, is published any time as a prompt report as occasion requires. In this report, the title, names of reporters and summary of each of 53 researches which were carried out under the visiting research program in the first half of 1983 are given. The titles are, for example, a mechanism for the anodic oxidation of GaAs, gamma-gamma perturbed angular correlation study of relaxation phenomena, the studies on the genesis of volcanic rocks by partition of trace elements, neutron activation analysis of geochemical standard rock samples, studies on the changes of elements in the fur of rats with various disease, neutron activation analysis on glacier ice strata and glaciegla lake sediments in Nepal Himalayas, low temperature irradiation effects on bcc metals, organ and its subcellular distribution of manganese ion in animals, structure analysis of orthorhombic $BaTiO_3$ by profile analysis method, regional distribution of Mn, Zn and Cu in human brain, neutron diffraction study of Mn-Ni alloy, structural change of $KCoF_3$ in the vicinity of the critical region, activation analysis of trace elements in tumor tissues (thyroid) and so on.

9246 (ORNL/PPA—86/2) **Oak Ridge National Laboratory institutional plan, FY 1987-FY 1992.** (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87002991.

Oak Ridge National Laboratory's planned research, development, and demonstration activities associated with energy production and conservation, as well as basic research in the physical and life sciences are described through 1992. The views of the Laboratory's senior management about the future and about the role of ORNL are given. ORNL initiatives are briefly summarized. The range of ORNL's scientific and technical programs is described, including work for DOE and work for other sponsors. The site and facilities of the laboratory are described, and external interactions are discussed. Projected funding is tabulated. (LEW)

9247 (UTNL-R—0177) **Report of the research results with University of Tokyo, Nuclear Engineering Research Laboratory's Facilities in fiscal 1984.** (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). 1985. 117p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700314.

The repair of fuel in the reactor "Yayoi" was completed as scheduled, and after a certain period of test and preparation operation, the utilization was able to be resumed in fiscal year 1984. The electron beam linear accelerator started the operation in April, 1977, and the utilization has been smoothly continued. In this report, the gists of 10 researches on pile, 13 researches off pile, and 19 researches by utilizing the linear accelerator are collected. For each report, the research number, title, the names of reporters and the summary of research are given.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 9235, 9260, 9347

9248 (DOE/EIA—0478(85)) **Uranium industry annual 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Nov 1986. 145p. NTIS, PC A07/MF A01 - GPO; 1; GPO Dep. File Number DE87003059.

This report consists of two major sections: The first addresses uranium raw materials activities and covers the following topics: exploration activities and expenditures, resources and reserves, mine production of uranium, production of uranium concentrate, and industry employment. The second major section is concerned with the following uranium marketing activities: uranium purchase commitments, uranium prices, procurement arrangements, uranium imports and exports, enrichment services, inventories, secondary market activities, utility market requirements, and related topics. A glossary and appendices are included to assist the reader in interpreting the substantial array of statistical data in this report and to provide background information about the survey.

9249 (DOE/S—0052) **Energy Research Advisory Board, Civilian Nuclear Power Panel: Subpanel 1 report, Light water reactor utilization and improvement: Volume 2.** (USDOE Office of Energy Research, Washington, DC. Energy Research Advisory Board). Oct 1986. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002956.

The Secretary of Energy requested that the Office of Nuclear Energy prepare a strategic national plan that outlines the Department's role in the future development of civilian nuclear power and that the Energy Research Advisory Board establish an ad hoc panel to review and comment on this plan. The Energy Research Advisory Board formed a panel for this review and three subpanels were formed. One subpanel was formed to address the institutional issues surrounding nuclear power, one on research and development for advanced nuclear power plants and a third subpanel on light water reactor utilization and improvement. The subpanel on light water reactors held two meetings at which representatives of the DOE, the NRC, EPRI, industry and academic groups made presentations. This is the report of the subpanel on light water reactor utilization and improvement. This report presents the subpanel's assessment of initiatives which the Department of Energy should undertake in the national interest, to develop and support light water reactor technologies.

9250 (INIS-mf—10512, pp 54) **Assessment of nuclear reactor system alternatives.** Molin, A. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). 1986. NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9251 (INIS-mf—10514, pp vp) **Communications: roots of our problems.** Olds, F.C.; Olds, N.S. Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9252 (INIS-mf—10514, pp vp) **Radioactive waste, the earth's crust, and the human society.** Rometsch, R. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle, NAGRA, Baden, Switzerland). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9253 (INIS-mf—10515, pp 17-18) **CSAEC tutor board: its necessity and use for technical and economic promotion of the Czechoslovak nuclear programme.** Kriz, Z. (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The article informs of scientific, technical and economic publicity on the peaceful uses of nuclear power. A board of tutors has been established whose activity is divided into seven subject areas. (E.S.).

9254 (INIS-XN—20) **Agreement between the Government of the Kingdom of Belgium and the Government of the Peoples' Republic of China on Cooperation in the Peaceful Uses of Atomic Energy.** (International Atomic Energy Agency, Vienna (Austria)). 18 Apr 1985. 12p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700295.

Under the Agreement both Parties agree in particular to co-operate on reactor research, construction and design, nuclear fuel fabrication and technology, nuclear safety and radiation protection, R and D in nuclear science and technology, etc. The Agreement specifies that co-operation shall be for exclusively peaceful purposes and that the security measures applied for the nuclear materials and equipment as well as for the technical information covered by the Agreement shall be those defined by the International Atomic Energy Agency (IAEA). The Agreement entered into force on the date of its signature for a period of fifteen years and may subsequently be extended for five-year periods successively.

9255 (INIS-XN—21) **Agreement between the Government of the Kingdom of Belgium and the Government of the Arab Republic of Egypt concerning co-operation in the peaceful uses of nuclear energy.** (International Atomic Energy Agency, Vienna (Austria)). 27 Nov 1985. 5p. (In French, Dutch and English). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700296.

Published in Moniteur Belge - No. 17502.

The Agreement covers among others planning, construction and operation of nuclear power plants in Egypt, as well as other nuclear facilities and research establishments; safety of nuclear facilities and radiation protection; exploration and exploitation of uranium resources; scientific and technological research and development, etc. The parties have undertaken that no material, equipment or information transferred under the Agreement will be used in such a way as to result in a nuclear explosive device, and that such material and equipment will be subject to safeguards as specified in an agreement with the IAEA in accordance with the Non-Proliferation Treaty. The Agreement entered into force on 1st August 1985 for a period of thirty years and may subsequently be extended for five-year periods.

2910 Conservation

9256 (DOE/CE—0165) **Ninth annual report to Congress on Federal Energy Conservation Programs, fiscal year 1985.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Sep 1986. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002958.

This Annual Report to the Congress on Federal Energy Conservation Programs describes the energy conservation and management activities of the Federal Government for Fiscal Year 1985 authorized by Section 381 of the Energy Policy and Conservation Act (EPCA) of 1975 (Pub. L. 94-163), 42 U.S.C. 6361, and Title V, Subtitle H of the Energy Security Act (ESA) of 1980 (Pub. L. 96-294), 42 U.S.C. 8286 et seq.

9257 (DOE/CE—0171) **Annual report on Federal Government energy management, Fiscal year 1985.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Aug 1986. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002988.

During FY 1985, the Government of the United States used 1.9 Quadrillion British Thermal Units (Quads) of energy for buildings, facilities, and operations to provide essential services to its citizens, including the defense of the nation. This 1.9 Quads consumed is 2.5% of all energy used in the United States. In total, the Federal Government is the single largest energy consumer in the nation, although its pattern of consumption is widely dispersed at more than 8000 locations worldwide. Total Federal energy consumption in FY 1985 was 2.7% less than FY 1975 - the base year against which energy usage is measured. The cost of this energy was $10.6 billion and represented 1.1% of the total Federal expenditures of $946.3 billion for all purposes in FY 1985. The Federal energy bill for FY 1985 decreased approximately $1.1 billion from the $11.7 billion reported for FY 1984. The continued decline in the cost of jet fuel accounted in large measure for this decrease.

9258 (INIS-mf—10315) **Consumer energy conservation policies and programs in the Netherlands.** Boer, J. de; Ester, P.; Mindell, C.; Schopman, M. (Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft; Vrije Univ., Amsterdam (Netherlands). Inst. voor Milieuvraagstukken). 1983. 263p. (In English and Dutch). NTIS (US Sales Only), PC A12/MF A01. File Number DE87750312.

Consumer Energy Conservation Policies (CECP). Technical reports.; Vol. 8.; This document supersedes IIES-dp--83-6.

This report presents an overview of consumer energy conservation policies and programs in the Netherlands and analyses them in terms of program objectives, conservation strategies, program instruments, context elements, and impacts on energy consumption, on consumers' lifestyles and on the environment. Part 1 briefly outlines the energy situation in the Netherlands. Diversification of energy sources and conservation of energy use are the main themes of Dutch energy policy. Controversial issues are the export volume of natural gas and the acceptability of nuclear energy. Part 2 describes and evaluates a number of consumer energy conservation programs. A broad range of programs is presented, including governmental programs (mass media compaigns, the national insulation program), initiatives from consumer organizations and environmental groups, as well as projects on the community level. Part 3 summarizes the main findings and suggests some policy recommendations. The climate of opinion in the Netherlands appears to be quite favorable towards energy conservation. The commitment to conserve, however, is not very strong. Given the broad variety of conservation programs the necessity of coordination is emphasized. As consumers tend to be weakly represented in the program agencies, it is recommended to extend or introduce their participation. Particular attention is given to the lack of evaluation studies. Usually, program impacts are unknown. The desirability of utilizing community level indicators in the assessment of energy conservation policy is underlined.

9259 (NP—7770035) **Thermo-economic analysis of energy conversion processes.** Tsatsaronis, G. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 8 Jan 1985. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87770035.

By means of an exergetic analysis the degree of perfection of an energy conversion process can be investigated and the limits of possible improvements of such processes can be determined. But exergy is not an economic quantity. For instance one is not generally justified in assuming the costs of exergy units of different process products to be equal. The combination of the exergetic with an economic process analysis can constitute a substantial contribution towards showing more clearly the relationships between thermodynamic and economic quantities and towards making a comparative evaluation of different technical solutions to a task given. That combination facilitates also the development of alternative processes safeguarding an improved economic efficiency of the process. The work presents and discusses different methods for thermo-economic process analysis. Methods for analytical thermo-economic optimization, for establishing the cost of the exergy unit of all plant streams, and of thermo-economic isolation are complicated and consequently suited only for such processes where the flow diagram of the plant remains unchanged in the course of the investigation. By contrast, the remaining methods for thermo-economic process evaluation can also be employed at an earlier stage of process design.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 8895, 9234, 9248

9260 (INIS-XN—52) **Summary of nuclear power and fuel cycle data in OECD member countries.** (Nuclear Energy Agency, 75 - Paris (France)). Apr 1986. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750722.

A questionnaire on Electricity Generation, Nuclear Power and Fuel Cycle Data is distributed annually to OECD Member Countries. In the questionnaire of January 1986, countries were asked to provide historical data for 1984 and 1985 and most likely projections up to the year 2005. The replies to the questionnaire are presented in this Summary. Not all countries have revised or made new projections since the April 1985 issue. Too few countries were able to provide projections beyond 2000 to include data for 2005 in this year's Summary. Data for 1985 are in some cases provisional. Where no data were available the Secretariat made estimates, based on information of IEA, IAEA, the previous Brown Book, OECD/IEA Energy Statistics and other sources. The electricity generation and production data for fuel cycle services refer to those facilities located within the country, and thus exclude imports. The fuel cycle requirements, however, refer to the amounts of fuel cycle services necessary for national nuclear power programmes. The Addendum contains an analysis of the present and past projections for OECD nuclear capacity to 2000.

9261 **(NP—7750796) Energy supplies in the Federal Republic of Germany. The reliability of supplies and strategies to provide for it.** Matthies, K. (HWWA-Institut fuer Wirtschaftsforschung Hamburg (Germany, F.R.). Informationszentrum). Jun 1985. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750796.

The IEA crisis management has so far not been required to demonstrate its full capacity and power. In spite of a number of crises in the Middle East oil has always been sufficiently available in the Western world. Even with the Gulf at war there have been abundant oil supplies and once again slackening petroleum prices on the world market for several years. This very situation did not fail to affect the different opinions on the reliability of supplies. While the Western German petroleum industry is being suffocated by accumulating idle refinery stocks and therefore protests against excessive provision making with the help of restrictive policies, the mining industry still meets with political support for a policy of stockpiling for the sake of reliable energy supplies. In view of the inflationary use of the reliability and safety concepts in political discussion the publication abstracted is trying to throw light on the meaning per se, the development of the supply situation in the Federal Republic of Germany since 1973 and on the applicability and costs of possible precautionary strategies taking effect in the case of suspended energy imports.

9262 **(NP—7750808) Republic of Korea - energy situation 1984.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jul 1986. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750808.

The energy situation of the Republic of Korea is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Important figures are presented on the country's external trade and balance of payments.

9263 **(NP—7750809) Republic of South Africa - energy situation 1983/1984.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1985. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750809.

The energy situation of South Africa is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Important figures are presented on the country's external trade and balance of payments.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 8867, 8892, 9232, 9262, 9263

9264 **(ENR-I—2-84/85) Alberta Energy and Natural Resources: Annual report, March 31, 1985.** (Alberta Energy and Natural Resources, Edmonton (Canada)). 1985. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87900166.

Canadian energy policy underwent a major evolution during the past year. The regulated environment which had been in place for oil pricing and marketing since 1973 and the onerous tax burden of the National Energy Program gave way to a more market-oriented system with more equitable taxation. As a result the oil and gas industry's recovery was enhanced, and industry activity improved to levels close to those prevailing before the National Energy Program. The dismantling of the National Energy Program which began in September 1981 was completed with the conclusion of the Western Energy Accord in March 1985.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 8867, 8888, 8895, 9235

9265 **(DOE/EIA—0380(86/09)) Petroleum marketing monthly: September 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 28 Nov 1986. 155p. NTIS, PC A08/MF A01 - GPO; 1; GPO Dep. File Number DE87003337.

Information and statistical data are given about a variety of crude oils and refined petroleum products. The publication provides crude oil cost statistics and refined petroleum products sales statistics for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

2960 Electric Power

REFER ALSO TO CITATION(S) 9278, 10006, 10595

9266 **(BNL—38791) 1984 not-for-profit electric utilities data for the National Utility Financial Statement (NUFS) Model.** Spancake, L.R. (Brookhaven National Lab., Upton, NY (USA)). Sep 1986. Contract AC02-76CH00016. 178p. NTIS, PC A09/MF A01; GPO Dep. File Number DE87003227.

To assemble the 1984 Historic Data File of publicly owned electric utilities for the NUFS model, Brookhaven National Laboratory used three data sources that had not previously been included in this database: annual reports from individual state/municipal utilities, data from the Rural Electrification Administration (REA) and direct responses on specific data items from the federal power systems.

9267 **(DOE/EIA—0499) Financial analysis of investor-owned electric utilities.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Nov 1986. 109p. NTIS, PC A06/MF A01 - GPO; 1; GPO Dep. File Number DE87002887.

This report reviews the past and projected financial condition of the investor-owned electric utilities from 1970 to 1995, with emphasis on regulatory responses to financial problems in the 1970's. Projections are based on tax law as it existed on January 1, 1986; however, an analysis of the projected effects of the Tax Reform Act of 1986 (Public Law 99-514) is included.

9268 **(DOE/IE—0008) Electric power supply and demand for the contiguous United States, 1986-1995: Staff report.** (USDOE Assistant Secretary for International Affairs and Energy Emergencies, Washington, DC). Dec 1986. 158p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87003616.

This report reviews the bulk electric power supply and demand situation projected by the electric utility industry for the contiguous United States in the decade 1986-1995. The review is based primarily on the April 1, 1986, Coordinated Bulk Power Supply Program Reports (Form IE-411) submitted to the Department of Energy by the nine Regional Electric Reliability Councils.

9269 **(EPRI-EA—4851) Priority service: Unbundling the quality attributes of electric power: Interim report.** Oren, S.S.; Smith, S.A.; Wilson, R.B. (Pricing Strategy Associates, Orinda, CA (USA)). Nov 1986. 173p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920114.

Priority service is a special kind of product differentiation that increases the range of choices available to customers. The basic idea is to unbundle service reliability into a spectrum of priority classes, each priced to reflect the cost to the utility of providing that quality of service. This report summarizes the concepts and insights developed during the initial phase of research, addressing issues of incentives, pricing, capacity planning, priority insurance, and market organizations.

9270 **(EPRI-EA—4879) Capital budgeting for utilities: The revenue requirements method: Final report.** (Charles River Associates, Inc., Boston, MA (USA)). Oct 1986. 132p. Research Reports Center, Box 50490 Palo Alto, CA 94303. File Number TI87920112.

This report is an exposition of the revenue requirements method for project evaluation in the electric utility industry. The results are developed from first principles of economics and finance. Application of the results is illustrated by a series of hypothetical calculations. Revenue requirements are a way of expressing the costs associated with an investment. The revenue requirements method can be used to choose among alternatives that provide an equivalent amount and quality of service. If alternatives do not provide equivalent service, then the appropriate economic comparison depends on the value of service as well as the cost. Market discount rates rather than so-called "customer discount rates" should be used to calculate the present value of revenue requirements. In general, however, the risk-adjusted discount rates that are appropriate for calculating the present value of revenue requirements differ from those used to calculate net present value.

9271 **(EPRI-EM—4519-Vol.3) Advanced commercial survey methods (COMSURV): Volume 3, Demonstration of optimum sample design for nonresponse bias control: Final report.** McCarthy, P.M.; Bethel, J. (Applied Management Sciences, Inc., Silver Spring, MD (USA)). Oct 1986. 103p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920128.

This report documents demonstration of a procedure for controlling nonresponse bias in survey estimates. The procedure requires subsampling and collecting data from nonrespondents, using more intensive and costly procedures than the original survey. The report describes statistical methods for optimizing the overall design, including the initial sample and the follow up subsample. The optimization can be constructed to either minimize error at fixed cost, or minimize cost for fixed precision. Necessary equations are provided. The report documents the results of applying these procedures in a 1985 mail survey of the commercial sector conducted by the Potomac Electric Power Company, serving the District of Columbia and suburban communities in Maryland. The results indicated that without nonresponse corrections the estimates would exhibit severe negative bias, ranging up to 100%. Results also indicated that the corrective procedures successfully removed the biases. The demonstration also revealed the procedures to be practical and accessible to industry practitioners requiring only personal computer hardware and spreadsheet-type software.

9272 **(EPRI-EM—4815-SR) Impact of demand-side management on future customer electricity demand.** Keelin, T.W.; Gellings, C.W. (Electric Power Research Inst., Palo Alto, CA (USA)). Oct 1986. 68p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920126.

Estimates of the impact of demand-side management (DSM) on future US electricity demand indicate that DSM will affect both the magnitude of peak demand and the shape of the daily load curve. Furthermore, it will probably reduce future electric energy requirements.

9273 **(EPRI-EA—4807-CCMS-Vol.1-Pt.2) Utility Planning Model (UPM): Version 2.0, System documentation and user's manual: Volume 1. Part 2, Standard reports: Computer code manual.** Kohlmeier, J.M.; Heinemann, M.E.; Schlick, F.J.; Phillips, J.P. (Andersen (Arthur) and Co., Chicago, IL (USA)). Oct 1986. 690p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920119.

Developing cost-effective utility plans to meet uncertain future load and financial requirements is increasingly difficult to accomplish. The enhanced version of the utility planning model (UPM) increases a utility's ability to develop accurate and comprehensive evaluations of its planning options in a timely manner.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 8888, 9233, 9248, 9265, 9305

9274 **(DOE/EIA—0035-86/08) Monthly energy review, August 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 24 Nov 1986. 127p. NTIS, PC A07/MF A01 - GPO; 1; GPO Dep. File Number DE87002882.

Statistics are cumulated monthly and annually for production, consumption, and imports for petroleum, natural gas, coal and electric power.

9275 **(DOE/EIA—0376(84)) State energy price and expenditure report 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 4 Dec 1986. 235p. NTIS, PC A11/MF A01 - GPO; GPO Dep. File Number DE87003378.

The average price paid by US consumers for energy in 1984 was $8.43 per million Btu, down 0.5% from the 1983 average price of $8.47 per million Btu. While the average price changed very little, total expenditures rose 5% from $418 billion in 1983 to $438 billion in 1984 due to increased energy consumption. By energy source, prices showed the most change in petroleum and electricity: the average price paid for petroleum products fell from $7.79 per million Btu in 1983 to $7.62 per million Btu in 1984, and the average price paid for electricity increased from $18.62 per million Btu in 1983 to $19.29 per million Btu in 1984. Expenditures in 1984 hit record high levels for coal, natural gas, nuclear fuel, and electricity, but were 16% below the 1981 peak for petroleum.

9276 **(ORNL/TM—10052) Residential demand for electricity and distillate fuel oil.** Rizy, C.G.; Vogt, D.P. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87002981.

This report documents the development of a forecasting model of the demand for electricity and distillate fuel oil in the residential sector. The model, developed by Oak Ridge National Laboratory (ORNL), is designed to address two needs of the Department of Energy (DOE) Office of Environmental Analyses (OEA): (1) the need for a general framework to conduct analyses of historical trends of energy consumption patterns; and (2) the need for a base for projecting alternative assumptions of national and regional energy consumption and fuel prices. The model is data driven, using fuel consumption data from the Energy Information Administration (EIA) State Energy Data System (SEDS), price data from EIA's State Energy Price System (STEPS) data base and economic and demographic variables, such as population and income, from a previously existing ORNL data base of residential sector-specific variables. The framework uses the data management and statistical analyses capabilities of the Statistical Analysis System (SAS) to perform the data preparation, regression analyses and forecasting. The general framework, in addition to the use of SAS, provides the user the great flexibility in terms of employing alternative forecasting scenarios or extending the model to other sectors (i.e., commercial or industrial).

2990 Unconventional Sources And Power Generation

9277 **(NP—7770034) Optimizing the design output of a renewable energy system. Model calculations with regard to the Energy Laboratory at Oldenburg.** Gabler, H. (Oldenburg Univ. (Germany, F.R.). Fachbereich 8 - Physik). 29 Jan 1985. 145p. (In German). NTIS (US Sales Only), MF A01. File Number DE87770034.

This work constitutes a contribution towards the development of systems utilizing renewable energy under the climatic conditions of central Europe. The investigation is restricted to systems by which useful electrical energy is produced at no great distance from the consumer and without having recourse to external systems of supply. A demonstration system, the energy laboratory at Oldenbourg, served to investigate the behaviour of a wind energy converter and a photovoltaic generator which, together with a conventional additional energy source and a battery storage system, supplied energy to a small university building. Considering the structure of the meteorological data of a typical site in north-western Germany and considering the energy investments for converters of renewable energy as assessed in the work, design outputs were shown to have minimum energy payback periods if they satisfied the following conditions: As a yearly average, wind and solar radiation have approximately the same share in power generation, the sum of generation from wind and solar radiation is about equal to the annual demand, the size of the reservoir is such that it allows demand to be covered for about 24 hours from the reservoir. Systems of a corresponding design output cover near to 80% of demand by renewable energy. The work not only describes the model and points out the results of the simulation calculations but offers moreover a survey of the methods developed up to now for modelling and determining the design output of thermal energy systems.

9278 **Analysis of feedstock supply costs for wood-fired electric power plants in Liberia, West Africa.** Barron, W.F.; Perlack, R.D.; Samuels, G. (Oak Ridge National Lab., TN). *Natural Resources Forum;* 10: No. 4, 351-361(Nov 1986).

In Liberia, as in many developing countries, electrification of towns and cities throughout the country has long been a major development goal. However, fuel expenditures by the Liberian Electricity Corporation (LEC) for its rural public stations represent a major and growing burden on the financially hard-pressed utility. This paper evaluates the economics of supplying wood to rural electric power plants utilizing different sources of feedstock. The authors also evaluate the cost implications of differences in wood supply requirements based on the use of steam or gasifier technology, and from variation in plant utilization level. The wood supply considered as sources are: (1) retired rubber trees; (2) harvesting of secondary-growth forest just before the land is returned to temporary cultivation; (3) establishment of commercial short-rotation wood energy plantations; and (4) adding to the system of shifting agriculture the planting of fast-growing wood species. Results indicate that wood can probably be supplied under a wide range of supply and demand conditions for US $1.00-1.70 per GH. It is estimated that wood steam plants can generate power for about $0.09-0.14 per kWh and gasifier plants for $0.10 to 0.18 per kWh. These costs are well below the present cost of oil-based rural electric power generation in Liberia (about $0.20-0.27 per kWh). 17 references, 1 figure, 7 tables.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

9279 **(MHD-III—86-066) Coal-fired MHD Combustor Development Project: Phase 3D: Tenth quarterly report, [August 1 to October 31, 1986].** (TRW, Inc., Cleveland, OH (USA)). 20 Nov 1986. Contract AC22-84PC70508. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002854.

This tenth quarterly technical progress report of the Coal-Fired MHD Combustor Development Project (Phase IIID) presents the accomplishments during the period August 1 to October 31, 1986. The work encompasses development work on the 50 MW/sub t/ combustor related to test support at the CDIF, performance analysis of the CDIF results, design of a low preheat coal feed system, and improvements to the combustor first stage design. Progress is summarized below: (1) Ten power train hot-fire tests were conducted at the CDIF accumulating approximately 29 hours of coal burn time and 17.5 hours of power generation. Six tests were conducted in the Faraday mode of channel operation which accounted for 7.6 hours of the total power generation. The remaining tests were conducted in diagonal mode of operation. Two extended duration tests were accomplished, one in the Faraday mode which accumulated 7 thermal hours and 5 power hours and one in the diagonal mode which accumulated 8.5 thermal hours and 7 power hours. (2) A data review/test planning meeting was held at TRW on 17 September 1986. Data from the FY 1986 CDIF test program were reviewed and the FY 1987 test plan was formulated. (3) The CFC power train performance analysis task continued during this reporting period. Primary emphasis was the investigation of apparent differences in the performance characteristics of the CFC power train and the AIC power train. (4) The detail design of an improved first stage CFC slag dump section was completed. The Critical Design Review (CDR) was held with DOE on 15 September 86.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 9109

9280 **(DOE/CE/40651—1) Research program on the sodium heat engine: Final technical report for Phase 4, 28 September 1983-30 April 1986.** Hunt, T.K. (Ford Motor Co., Dearborn, MI (USA). Scientific and Research Lab.). 25 May 1986. Contract AC02-83CE40651. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002941.

This report covers all work performed by the Ford Motor Company during the period 28 September 1983 - 30 April 1986, titled 'Research Program on the Sodium Heat Engine (SHE).' The research program was pursued in order to meet the following main objectives: (1) Operation of a self-contained, self-pumping recirculating cell with a non-electrical heater. (2) Operation of a SHE system giving a conversion efficiency of 25%. (3) Operation of a recirculating cell having an effective radiation resistance of 15 or more. (4) Operation of a SHE system producing 100 to 200 watts of electric power output. This final report contains discussions of all aspects of the contract work performed in pursuit of these goals and includes in an appendix, abstracts of all of the technical publications dealing with or attributable to work performed under the contract.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 9043

9281 **(CONF-860102—13) Monolithic fuel cell based power source for sprint power generation.** Fee, D.C.; Bhattacharyya, S.K.; Busch, D.E.; Carlson, L.W.; Claar, T.D.; Dees, D.W.; Dusek, J.; Easler, T.E.; Ellingson, W.A.; Flandermeyer, B.K. (Argonne National Lab., IL (USA)). Jan 1986. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86014603.

From 3. symposium on space nuclear power systems; Albuquerque, NM, USA (13 Jan 1986).

A unique fuel cell coupled with a low power nuclear reactor presents an attractive approach for SDI burst power requirements. The high power, long duration bursts, quoted in the open literature, (100 MWe, 200 sec) appear achievable within a single shuttle launch limitation with appropriate development of the concept. The system performance advantages result from a significant breakthrough in fuel cell design. The monolithic design employs the same thin ceramic components used in other oxide fuel cells in a strong, lighweight honeycomb structure of small cells, and thus can achieve very high power per unit mass or volume. The light weight and low volume as well as the efficiency and reliability of electrical systems, are advantageous in space applications.

9282 **(EUR—9049) Alkaline fuel cell with a hydrogen electrode.** Doniat, D.; Rouget, R. (Commission of the European Communities, Luxembourg). 1984. 87p. (In French). Commission of the European Communities, Luxembourg.

This report concludes our study concerning an alkaline fuel cell with matrix. Tests to make electrodes directly on the matrix were not successful: the best way to realize the fuel cell is to build electrodes and matrix separately. The electrodes are made with a novel structure: a foam of nickel with a layer of nickel Mond. Good electrical conductivity and excellent catalyst adhesion to the current collector are obtained. To lower the price of the fuel cell in view of an E.V. application, no precious catalysts are used: Raney nickel and silvered carbon. Air cathode performances are improved by introducing some silver in the Mond layer. The matrix is preferably composed of a plastic felt (such as NORDLYS) and a porous polypropylene sheet (as CELGARD 3501): so high bubble point, low electrical resistivity and high electrolyte retention are obtained. With our fuel cell, 2500 h test under 150mA/cm^2 and at 80°C temperature are obtained. A technico-economic study shows that, in these conditions the fuel cell cannot be used for the E.V., because of the very low price of energy required (300 FF/kW).

9283 **Corrosion prevention in molten carbonate fuel cells.** Singh, P.; Paetsch, L.; Maru, H.C. (Energy Research Corp., Danbury, CT 06810). pp 1-13 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Molten carbonate fuel cell components sometimes experience accelerated corrosion in the presence of molten electrolyte and fuel and oxidant gases. Thermodynamically stable coatings and corrosion resistant materials have been based on accelerated corrosion tests. Aluminium-rich wet seal coatings minimize wet seal corrosion and electrolyte migration.

9284 **Hot corrosion of chromium in (Li/sub 0.62/K/sub 0.38/)/sub 2/Co/sub 3/ at 650°C.** Hsu, H.S. (Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN 37831). pp 1-10 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—). Contract AC05-84OR21400.

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Hot corrosion was studied in carbonate salt under proto-typical molten carbonate fuel cell environments. With the aid of phase stability diagrams of the Cr-Li-K-C-O system, the corrosion kinetics and scale morphologies are examined. The corrosion process in oxidizing atmospheres was divided into three distinct phases: (1) the formation of liquid corrosion product, chromate, from the reaction of carbonate and chromium; (2) the formation of nonprotective Cr/sub 2/O/sub 3/ scale under the liquid corrosion product; and (3) localized hot corrosion in the Cr/sub 2/O/sub 3/ scale due to the dry-out of the liquid corrosion product. The corrosion behavior in the oxidizing environment is primarily dependent on the oxygen concentration. Catastrophic corrosion can be alleviated by lowering the oxygen partial pressure in the gas phase. Little corrosion was observed under reducing gas environments. This low corrosion rate of chromium was the result of the scarcity of oxygen in the reducing gas atmosphere.

9285 **Materials characterization of phosphoric acid fuel cell system.** Venkatesh, S. (Westinghouse Electric Corp., Advanced Energy Systems Div., P.O. Box 10864, Pittsburgh, PA 15236-0864). pp 1-6 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

The materials used in phosphoric acid fuel cells (PAFC) must have mechanical, chemical, and electrochemical stability to withstand moderately high temperature (200°C), pressure (500 kPa) and highly oxidizing nature of phosphoric acid. This study discusses chemical and structural stability performance and corrosion data of certain catalysts, catalyst supports, and electrode support materials used in PAFC applications.

9286 **Conductive oxides for molten carbonate fuel cell cathodes.** Smith, J.L.; Kucera, G.H.; Minh, N.Q. (Argonne National Lab., 9700 South Cass Avenue, Argonne, IL 60439). pp 6 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—). Contract W-31-109-ENG-38.

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Development work on alternative cathode materials for the molten carbonate fuel cell is reported. The work has centered on improving and/or stabilizing the conductivity of LiFe0/sub 2/ and Li/sub 2/Mn0/sub 3/. The results of tests on doped samples (Mg, Mn, Cu dopants) are reported. Doping, although not yet optimized, has yielded stable materials with resistivities within a factor of 2-5 of the original target value. Work is continuing to better understand and optimize these materials and to examine other dopants.

3008 Miscellaneous Converters

9287 **Apparatus for deriving energy from variation of the level of a body of fluid.** Thompson, R. Jr.; Blanco, E. US Patent 4,622,812. 18 Nov 1986. Filed date 23 Apr 1985. v.p.

An apparatus is described for deriving energy from periodic rise and fall of the level of a body of liquid, comprising float means disposed upon the body of liquid and adapted to move substantially in a vertical plane in response to the periodic rise and fall of the body of liquid, a cylinder having a piston therewithin, the piston adapted for vertical movement relative to the cylinder in response to rise and fall of the float with the body of liquid, in a manner to apply force to fluid in a chamber of the cylinder. The force is applied alternately to opposed chambers of the cylinder, the piston being fixed and the cylinder being mounted to rise and fall relative to the piston in response to the periodic rise and fall of the level of the body of liquid, and, disposed at a location removed from the body of liquid, means for converting force applied to the fluid to energy, and an accumulator connected for receiving fluid from the chamber for storing energy in the form of gas pressurized within the accumulator by force applied to the fluid and connected to the means for converting force applied to the fluid to energy.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 9258, 9322, 9905

9288 **(AD-A—172342/8/XAB) Direct digital control of HVAC (heating, ventilating, and air conditioning). User's guide.** Kirts, R.E. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Jan 1985. 89p. NTIS, PC A05/MF A01.

Heating, ventilating, and air conditioning (HVAC) systems are now under going the most significant change in control technology in the past 100 years. This change is the introduction of direct digital control (DDC) to HVAC systems. Computer control has been introduced to many things over the past few years, from automobile engines to home appliances to most industrial processes, but only recently have small computer control systems been introduced into the space conditioning industry. To understand the implications of this new HVAC control technology, it is necessary to consider several questions: (1) What is DDC and what are its capabilities: (2) Under what conditions is DDC a cost-effective alternative to conventional control. (3) What constitutes good system design and installation practice. This report addresses these questions by presenting information that describes DDC, presents its advantages and disadvantages, and gives applications guidance.

9289 **(BNL—38869) Optimized ground coupled heat pump design: Phase 1, Final report.** Andrews, J.W.; Catan, M.; Le Doux, P.; Metz, P.D.; Saunders, J.H. (Brookhaven National Lab., Upton, NY (USA)). Aug 1985. Contract AC02-76CH00016. 95p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003215.

This report describes the first phase of a project to design a water-to-air heat pump optimized for ground coupling applications. The project is being conducted jointly by Brookhaven National Laboratory (BNL), Oak Ridge National Laboratory (ORNL), and an industrial partner to be selected via a competitive procurement. In the completion of Phase I, three major tasks were completed. First, based on experimental work performed at BNL, water-refrigerant heat exchanger models were developed for incorporation into the ORNL heat pump optimization program. Next, a procedure was developed to generate correlations between heat pump entering fluid temperature and load. The correlations, called "Source Temperature/Load Maps", will tell the optimization program how many hours/season the heat pump will operate with any pair of values for these quantities. This report discusses these first two tasks within Phase I.

9290 **(CONF-870101—3) The effect of void fraction correlation and heat flux assumption on refrigerant charge inventory predictions.** Rice, C.K. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 33p. NTIS, PC A03. File Number DE87002810.

From American Society of Heating, Refrigerating, and Air-Conditioning Engineers meeting; New York, NY, USA (18 Jan 1987).

Ten void fraction correlations and four heat flux assumptions are evaluated for their effect on refrigerant charge inventory predictions. Comparisons between mass inventory predictions are made for condensers and evaporators over representative heat pump operating ranges of saturation temperature, mass quality, and mass flux. The choice of void fraction model is found to have a major effect on refrigerant inventory prediction. The maximum variation of predictions ranges from a factor of 10 for low-ambient, heating-mode evaporators to 4.2 for cooling-mode evaporators and 1.7 for high-ambient cooling-mode condensers assuming no subcooling. The correlations of Hughmark, Premoli, Tandon, and Baroczy are found to give the highest predictions and closest agreement to measured total system charge. The choice of heat flux assumption is shown to be insignificant for forced-flow evaporators and of secondary to possibly equal importance to choice of void fraction model for condensers. Implications for charge balancing, off-design and transient performance prediction, and unit reliability are discussed.

9291 **(DOE/CE—0166-Vol.1) Environmental assessment in support of proposed interim energy conservation standards for new commercial and multifamily highrise residential buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Systems Div.). Nov 1986. 200p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87003293.

The objective of this environmental assessment (EA) is to identify the potential environmental impacts that may result from implementing the proposed standard on federal sector construction of new commercial buildings. The EA does not examine the effects that the proposed standard may have as voluntary guidelines for the private sector, nor does it examine the environmental effects of proposed federal or private sector standards for residential construction. In this chapter, background information and statutory requirements that lead to the proposed standard and the EA are presented, followed by a discussion of the assessment's scope, objectives and approach. The report's contents are also briefly outlined.

9292 **(DOE/CE—0166-Vol.2) Economic analysis in support of proposed interim energy conservation standards for new commercial and multifamily highrise residential buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Systems Div.). Nov 1986. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003294.

The economic analysis of the proposed standard for design of Federal commercial buildings concludes that there are no significant adverse effects of adopting the proposed standard. An analysis akin to a regulatory flexibility analysis, contained in Chapter 5.0, likewise concludes that there are no significant adverse impacts on small businesses. The proposed standard will result in a positive net flow of benefits from energy savings, from reduced capital construction costs and from reduced operating and maintenance costs. These effects are small because forecasts of Federal construction of commercial buildings are small. Sensitivity analysis of the results concludes that the findings are not sensitive to even large changes in the underlying assumptions. Current ASHRAE changes to the standard analyzed are not different enough from those analyzed in this study to affect these findings.

9293 **(DOE/CE/23858—1) Technology for efficiency measurement of woodburning and other solid-fuel appliances: Phase 1 report.** Bell, R.M.; Graeser, L.; Jaasma, D.R.; Morren, W.E.; Rao, S.R.; Shelton, J.W. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA); Shelton Energy Research, Santa Fe, NM (USA)). [1986]. Contract AS05-83CE23858. 390p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE87002441.

The objective of the Phase 1 work was to develop the instrumentation and experimental methods which are needed to validate both existing and proposed flue loss methods. The instrumentation and methods were developed during the period 9/83 to 8/84, and in September 1984 the instrumentation was set up at the SER laboratory for the purpose of preliminary testing.

9294 **(DOE/CE/23858—T1) Method for measurement of water vapor concentration in woodstove stack gases.** Rao, S.R. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Oct 1985. Contract AS05-83CE23858. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87002775.

An instrument (differential flow water meter) to measure the water vapor concentration in stack gases was developed. This is intended for use as a standard reference as well as a practical method for the determination of the moisture content of stack gases from wood stoves. The accuracy of the instrument was tested by generating gas mixtures with known water vapor content and comparing the measured concentrations with the actual values. Several tests were made under actual operating conditions, i.e., testing the water vapor concentration of stack gases from a wood stove under different firing conditions. The accuracy of the results was further checked by weighing the condensed catch and comparing the measured and predicted values. For each of the tests a wet and dry bulb technique was also used to measure the stack gas moisture content. A comparison of the results obtained using these two methods and the WHA (Wood Heating Alliance) standard method was also done. The results show that the wet and dry bulb method overpredicts the moisture content as compared to the differential flow water meter.

9295 **(DOE/CE/23858—T3) Interferences with measurements of CO, CO_2, and O_2 in woodstove flue gases.** Morren, W.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Feb 1985. Contract AS05-83CE23858. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87002777.

Concentrations of CO, CO_2, and O_2 in woodstove flue gases are some of the measured inputs required by algorithms used to calculate woodstove efficiency by the stack loss method. Since these algorithms have been shown to be very sensitive to small errors in thes input values, it was necessary to determine whether measurements of these compounds are subject to interference. Concentrations of CO, CO_2, and O_2 in a series of flue gas samples were measured using a variety of independent measurement techniques for each compound. The concentrations indicated by each of the measurement techniques for each compound and sample were compared to check for agreement. Disagreement among the measurement techniques for a given compound could indicate interference if some trend could be established. Tests were conducted on four samples taken randomly during each of three stove firings.

9296 **(DOE/SF/12186—T1) Community energy Regional/Urban Design Assistance Team project: Final project.** (American Inst. of Architects Foundation, Washington, DC). Jul 1986. Contract FG03-84SF12186. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE87003181.

Since 1967 The American Institute of Architects (AIA) has conducted a program to help communities with their regional and urban design and planning problems. When a community asks the AIA for help, this Regional/Urban Design Assistance Team (R/UDAT) program arranges an intensive, four-day visit to a community by a multidisciplinary team of designers and planners who give the community expert, unbiased advice. The R/UDAT program has provided highly successful at identifying potential solutions to difficult community issues inexpensively and, because of the high levels of community-wide involvement and publicity surrounding the assistance team's visit, with active community support and consensus. This project tested the concept of using the AIA's R/UDAT model for raising awareness of and transferring community energy management strategies to actual communities. In each of three test R/UDAT's, community energy management problems were successfully addressed with solutions that drew on a wide range of community energy management strategies and took into account the particular community issues involved in the test situations.

9297 **(EUR—9256) Diesel engine driven heat pump.** Gondro, B.; Holz, W. (Commission of the European Communities, Luxembourg). 1984. 86p. (In German and English). Commission of the European Communities, Luxembourg.

Under the energy conservation programme of the European Communities, M.A.N. built, tested and carried out measurements on a diesel engine driven heat pump. Installation of the heat pump, together with measurement, control and monitoring equipment in a track container meet the requirement for compact design. The evaporator is installed on the container roof; it consists of 2 half units, one of which can be defrosted if necessary. Basically, the heat pump serves to produce hot sanitary water, and additionally space heating in winter. At actual duty it gives a heat output of 215 kW. Changing the r.p.m. over a range from 1200-2500 min^{-1} adjusts the output. To eliminate vibration problems, the mounting was designed on the basis of a mathematical model of a multi-body system. The measured values of air-borne and structure-borne noise lie well below the DIN values. Since 1982 control and operation of the installation has been fully automatic. During the heating period 1982/1983 the average annual primary energy ratio was 1.35; and the heat pump delivered 401 MWh thermal. In the final report design, construction work, timetable for completion of the project, project costs, economic viability and market prospects are also described.

9298 **(EUR—9788) Periodically operating absorption heat pump.** Knoche, K.F.; Grabenhenrich, H.B. (Commission of the European Communities, Luxembourg). 1985. 55p. Commission of the European Communities, Luxembourg.

Based on the simple idea of a periodically operating absorption heat pump, a directly fired type has been designed and built for space heating applications. The heat input is accomplished by means of a natural gas burner sized at approximately 10 kW and the low temperature heat source is furnished by the ambient air. Prior to the design, extensive investigations have been performed to determine the heat and mass transfer rates in the necessary components. In a laboratory size unit the transport phenomena for the ternary mixture methanol-water-lithium bromide have been measured first. Further on boiling tubes with varying geometries have been examined concerning their suitability as a generator with convective circulation. The performed investigations showed that a periodically operating absorption heat pump operates well and can be improved further on to become a heating device of high efficiency. However, the mechanical design remains quite simple and the operation is easy to regulate and to control.

9299 **(LBL—19683) Cutting energy costs in public housing: Technical issues, institutional barriers, and research needs.** Ritschard, R.; Goldman, C.; Vine, E.; Mills, E.; Greely, K. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. 39p. NTIS, PC A03/MF A01. File Number DE87003618.

As part of a US Department of Energy (DOE) program on multifamily retrofit performance, Lawrence Berkeley Laboratory initiated an effort to learn what is known about energy use and conservation in the public housing sector. This report provides a summary of that information including a profile of the existing data on energy use patterns and conservation potential in public housing drawn from two major reports, from a survey of 40 large public housing authorities, from a 1983 Conference, and from contacts with various HUD staff. It presents the physical characteristics of existing public housing buildings, their energy use patterns, and the potential for conservation. Also described are technical, informational, economic, behavioral, and institutional barriers that hinder the efforts of local housing authorities and HUD to promote energy conservation. We identify a set of research topics that can help overcome existing barriers. For each topic, a brief research agenda, for pursuit by DOE over the next few years, is developed. Studies have been initiated on four of the areas (reported elsewhere) including analyses of baseline energy use, retrofit performance, conservation investments, and the monitoring of solar hot water retrofits at one San Francisco housing project.

9300 **(LBL—22409) The residential standards demonstration program: Occupant survey analysis.** Vine, E.; Barnes, B.K. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098;AC79-83BP20521. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003626.

The Pacific Northwest is currently experiencing a dramatic and exciting transformation in the way the region produces and consumes energy. Prompted by federal legislation and local initiative, the region is promoting the conservation of energy as the primary new energy resource. In the residential sector, energy efficiency standards for new construction have been proposed, and a demonstration program is underway to examine the costs and energy savings associated with building houses to levels of higher energy efficiency. In this report, the participants in the demonstration program are examined to determine the similarities and differences of people living in "super" energy efficient houses compared to occupants of "current practice" ("control") houses.

9301 **(NIAE-Trans—532) Computer model of energy requirements in greenhouses. Part 1. A guide.** Breuer, J.J.G. (National Inst. of Agricultural Engineering, Silsoe (UK)). Nov 1985. 84p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from the Dutch. Rekenmodel energiebehoefte in kassen. Deel 1. Handleiding.

In order to calculate greenhouse energy requirements, in 1975 and 1976 a computer program was developed from a mathematical model which was based among other things on four temperatures, i.e. heating temperature, ventilation temperature, supply water temperature and outside temperature, together with global solar radiation. The results of the preliminary calculation have been determined for eight (seven different) crop combinations. After expanding, improving and modifying the model, it was used to calculate a number of variants, many new or repeated, for the same 8 crop combinations.

9302 **(NMRDI—2-73-4614) Max air conditioner development: Advanced indirect/direct evaporative cooling: Final technical report.** Bacchus, R.; Dowdy, J.; Guajardo, J. (Bacchus Industries, Inc., Sunland Park, NM (USA); Texas Univ., El Paso (USA)). Nov 1986. 71p. NTIS, PC A04/MF A01 - New Mexico Research and Devlopment Institute, Suite M, 457 Washington S.E., Albuquerque, NM 87108. File Number DE87003157.

This project developed and tested advanced evaporative cooling systems. Analysis of psychrometric information and test results are included. Indirect performance factors (PF) of 1.10+ were obtained on supply air systems (no return). Total PF's of over 1.50 and temperature drops of 55°F were obtained for indirect/direct evaporative cooling supply systems at 1% El Paso design conditions (100db/64wb ambient 45db supply with no return). A computer design model was developed and applications are indicated for evaporative cooling, refrigeration combination, desiccant cooling combination, and cooling towers. Bacchus Industries is pursuing commercialization of the developed technology.

9303 **(NP—7770033) Topical energy problems and their effects on architecture with special regard to computer simulation and computer-aided design as helps in decision making during design and planning processes.** Schmitt, G. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Architektur). 8 Feb 1983. 197p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87770033.

By nature hitherto architectonic answers to the challenge of energy shortages since 1973 cannot be of one and the same character due to the complexity of the energy aspect involved. However, it is difficult, if not impossible, to calculate the energetic behaviour of buildings using simple reckonings or rules of thumb. As separate calculations of several individual aspects cannot reflect the realistic energy demand of a building overall calculations are nevertheless required. This requirement accounts for the use of complex calculation models serving to simulate the influence of different aspects on the overall energetic behaviour of buildings. The application of simulation models as a means and vehicle of energy-conserving planning and projecting way as a matter of fact affect architecture. The publication abstracted points out conceivable consequences and the possible development of new basic architectonic concepts they involve. A brief survey of relevant publications and a concise chapter on data compilation and data analysis are followed by a discussion of energy demand, availability of energy supplies and energy prices as factors of architectonic decision making, possible effects on design and planning processes and effects of the energy aspect on present and future architecture.

9304 **(NYSERDA—86-8) Demonstration of new submetering technologies: Final report.** (Hirschfeld and Stone, Glen Cove, NY (USA)). Oct 1986. 130p. NYSERDA, Rockefeller Plaza, Albany, NY 12223. File Number TI87900299.

Four types of submetering systems were installed in four multifamily residential housing complexes located in New York City. The sites ranged from 100 to 800 units in size and comprised both low-rise and high-rise buildings. Three of these submetering systems fall under the category of new submetering technology. These types of systems are: (1) electronic metering utilizing carrier wave technology for cummunications; (2) electronic metering utilizing dedicated wiring for communications; and (3) hybrid, combining electromechanical metering with an electronic-type communications system. The fourth system installed utilizes conventional electromechanical metering. The objectives of this study include the evaluation of the three new submetering technology systems for such technical criteria as performance, reliability and accuracy, and of all systems for their economic impact by quantifying electrical energy savings at all four housing sites. In addition to the technical and economic considerations, tenant response to submetering is addressed in this study.

9305 **(PNL—5621) Comparative analysis of energy data bases for the industrial and commercial sectors.** Roop, J.M.; Belzer, D.B.; Bohn, A.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 100p. NTIS, PC A05/MF A01; GPO Dep. File Number DE87003697.

Energy data bases for the industrial and commercial sectors were analyzed to determine how valuable this data might be for policy analysis. The approach is the same for both end-use sectors: first a descrption or overview of relevant data bases identifies the available data; the coverage and methods used to generate the data are then explained; the data are then characterized and examples are provided for the major data sets under consideration. A final step assesses the data bases under consideration and draws conclusions. There are a variety of data bases considered for each of the end-use sectors included in this report. Data bases for the industrial sector include the National Energy Accounts, process-derived data bases such as the Drexel data base and data obtained from industry trade associations. For the commercial sector, three types of data bases are analyzed: the Nonresidential Building Energy Consumption Surveys, Dodge Construction Data and the Building Owners and Manager's Association Experience Exchange Report.

9306 **(PNL—6064) The implications of future building scenarios for long-term building energy research and development.** Flynn, W.T. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 130p. NTIS, PC A07/MF A01; GPO Dep. File Number DE87003588.

This report presents a discussion of alternative future scenarios of the building environment to the year 2010 and assesses the implications these scenarios present for long-term building energy R and D. The scenarios and energy R and D implications derived from them are intended to serve as the basis from which a strategic plan can be developed for the management of R and D programs conducted by the Office of Buildings and Community Systems, US Department of Energy. The scenarios and analysis presented here have relevance not only for government R and D programs; on the contrary, it is hoped that the results of this effort will be of interest and useful to researchers in both private and public sector organizations that deal with building energy R and D. Making R and D decisions today based on an analysis that attempts to delineate the nexus of events 25 years in the future are clearly decisions made in the face of uncertainty. Yet, the effective management of R and D programs requires a future-directed understanding of markets, technological developments, and environmental factors, as well as their interactions. The analysis presented in this report is designed to serve that need. Although the probability of any particular scenario actually occurring is uncertain, the scenarios to be presented are sufficiently robust to set bounds within which to examine the interaction of forces that will shape the future building environment.

9307 **(SERI/SP—273-2966) Cooling with ventilation.** Chandra, S.; Fairey, P.W. III; Houston, M.M. (Florida Solar Energy Center, Cape Canaveral (USA)). Dec 1986. Contract AC02-83CH10093. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86010701.

This document addresses the design of buildings using solar technologies integrated with air-conditioning to meet cooling needs in climates that seasonally experience both high temperatures and high humidity. Low-energy envelope design strategies that complement air conditioning are emphasized. The material deals primarily with detached single-family residences, although the principles are applicable to multistory apartment and condominium buildings and to small office and commercial buildings. Home builders and both present and future homeowners should find the contents useful.

9308 **Refrigerating cycle.** Okada, T. (to Kabushiki Kaisha Saginomiya Seisakusho, Tokyo). US Patent 4,622,829. 18 Nov 1986. Filed date 9 Dec 1985. v.p.

This patent describes a refrigerating system comprising: a condenser and an evaporator connected in series with each other; throttle means provided in the series connection between the condenser and the evaporator; a rotary compressor having a delivery port and a suction port, the delivery port being connected to the condenser by means of delivery tube. The suction port is connected to the evaporator by means of a suction tube; a check valve provided in the suction tube; differential pressure valve provided between the throttle means and the condenser in the series connection. The differential pressure valve has an elongated space therein including a valve section and a control section, the control section being divided by a diaphragm into first and second chambers; a first pressure introducing tube communicating the first chamber with the suction tube on the compressor side of the check valve; and a second pressure introducing tube communicating the second chamber with the suction tube on the evaporator side of the check valve; the differential pressure valve including valve means provided within the valve section thereof, the valve section being formed with a primary port communicating with the condenser and a secondary port communicating with the evaporator via the throttle means. The valve means is adapted to open or block communication between the primary port and the secondary port; actuator means connecting the diaphragm and the valve means and normally urged to maintain the valve means at an open position; and seal means for providing seal between the control section and the valve section.

9309 **Cogeneration microwave food dryer.** Bernstein, S.; Ushimaru, K. (to Energy International, Inc., Bellevue, WA). US Patent 4,622,757. 18 Nov 1986. Filed date 24 Dec 1984. v.p.

A method is described for efficient removal of moisture from a moist interior solid product with controlled physical change comprising the steps of: convection heating the solid product with a heated air stream to remove internal moisture to achieve a maximum moisture removal rate while maintaining the product below a predetermined maximum temperature thereby controlling additional physical change to the product, maintaining the convection heating until a predetermined critical moisture content of the product is achieved beyond which critical moisture content the drying rate decreases and the temperature of the product increases. The product temperature increases above the predetermined determined maximum with continued convection heating due to decreased evaporation and decreased surface migration of moisture, and then exposing the product to microwave radiation to increase moisture migration toward the product surface for removal and evaporation cooling to maintain the product below the maximum temperature until the desired moisture removal is completed, whereby the desired moisture will be efficiently removed from the product while controlling internal and surface physical change to the product.

3202 Transportation

9310 **Automotive drive guide system with error monitor for a magnetic compass therein.** Chujo, S.; Mitamura, K. (to Nissan Motor Co., Ltd., Kanagawa). US Patent 4,622,754. 18 Nov 1986. Filed date 10 Feb 1983. v.p.

This patent describes a direction sensor with an error monitor comprising: first means for detecting the orientation of the terrestrial magnetism and producing a periodic first signal indicative of the direction of terrestrial magnetism. The first signal has a signal phase which varies with a change in the orientation relative to the sensor and the first signal having a signal level proportional to the magnitude of the terrestrial magnetic field; second means for producing a second signal having a level representative of a predetermined reference value. The predetermined reference value is determined based on an initial signal level of the first signal under conditions in which an initial background noise exists at a predetermined signal phase of the first signal; and third means for detecting a subsequent signal level of the first signal at the predetermined signal phase thereof. The third means compares the detected subsequent first signal level to the second signal level to determine the difference between the signal levels, and a third signal when the first signal level is above the second signal level.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 9428

9311 **(CONF-8610169—1) Heat-of-Mixing Chemical Heat Pump program.** Kaplan, S.I. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001679.

From Department of Energy industrial heat pump workshop; Atlanta, GA, USA (14 Oct 1986).

The aim of the DOE Industrial Heat Pump Program is to conserve fuel in thermal manufacturing processes, by upgrading waste process energy to a temperature where it can be usefully and economically recycled into the process. To bring HMCHPs to a stage where they can achieve this, we are working to identify the most favorable cycles for various process conditions; develop working media that will operate reliably and economically at process temperatures of interest; and identify industrial applications where HMCHPs can save fuel and pay for themselves at the same time. We currently have calculational models that can analyze single-stage, regenerative, and various arrangements of dual-stage cycles, and at the same time provide cost comparisons between cycles, for a given application. We have identified and extensively characterized two high-temperature working fluid pairs, and are currently developing a calculational model for solid/vapor systems via a subcontract with a commercial laboratory. We are also funding a proof test of the nitrate mixture working fluid in a bench-scale heat pump mockup.

9312 **(ENV-MER—81-133) Potentialities of biotechnology for the reduction and utilization for energy purposes of wastes generated by food industry.** (Ministere de l'Environnement et du cadre de vie, 92 - Neuilly (France)). 19 Oct 1982. 166p. (In French). NTIS (US Sales Only), PC A08. File Number DE87750438.

The study dealt with the present trends in biotechnology related to the methods for the reduction and utilization, for energy purposes, of wastes generated by food industry and to the methods for controlling the emission of pollutants from industrial plants with emphasis on meat industry, dairy industry, food-packing trade, sugar industry, vinification, fatty foods, fish meal, beverage industry.

9313 **(EPRI-CS—4419-Vol.2) Fly ash design manual for road and site applications. Volume 2: Slurried placement.** McLaren, R.J.; Balsamo, N.J. (GAI Consultants, Inc., Monroeville, PA (USA)). Oct 1986. 181p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920074.

This report was produced as part of EPRI Research Project 2422. The goal of this project is to significantly increase the use of fly ash in all high volume uses and to increase its use in medium and high technology applications as well. This report is a utilization manual describing the design of various types of projects where fly ash has been used as a substitute for other common materials in high volume uses. High volume uses of fly ash are typified by structural and non-structural fills for site development, embankments for highways and railroads, backfills, highway subgrade improvement projects and base courses, grouting of subsurface voids, and other similar applications. This report is an integral part of the overall project and has been developed as a design manual pertaining to the use of fly ash as a construction material in these high volume uses. The manual is divided into two volumes. Volume 1 describes the use of fly ash conditioned with small amounts of water to produce a solid, soil-like material. This volume describes the use of fly ash mixed with sufficient water to create a fluid or semi-fluid material. In many applications, Portland cement and aggregate filler are also added to the mixture. The flowable nature of these materials determines the manner in which they are handled, placed, and used in construction. The following uses are discussed: Slurry Backfills, Grouting, and Hydraulic Fills. Miscellaneous uses are also discussed, including the use of fly ash in high fly ash concrete, unsintered synthetic aggregate, and slurry walls. Also included are three appendices containing additional information of interest to the designer: Mix Design, Laboratory Testing, and Bibliography. 19 refs., 53 figs., 12 tabs.

9314 **(EPRI-EM—4693) Heat pumps in evaporation processes: Final report.** Witherell, W.D.; Conneway, F.A. (Union Carbide Corp., South Charleston, WV (USA)). Nov 1986. 461p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920124.

Designing heat pumps for efficient use with process industry evaporators requires considering energy integration opportunities involving the entire process. With illustrative data from 10 case studies, this report provides guidance on energy-saving and cost-effective ways to integrate heat pumps into complex industrial processes.

9315 **(EUR—9140) Tracer study of the transfer parameters of processes regulating the chemical composition of input in cement kilns in order to maximize output.** Corompt, P.; Launay, M.; Gaillard, B. (Commission of the European Communities, Luxembourg). 1984. 69p. (In French). Commission of the European Communities, Luxembourg.

This research developed a method for studying the mixing capacity of the raw mill preparation circuits and of analysing the regulation processes implemented on these circuits and during baking of the clinker. The method identifies the causes of excessive consumption of energy in cement works with a view to eliminating them.

9316 (PNL—5322-Exec.Summ.) Energy and economic savings from improved catalysts: Executive summary. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003291.

The energy, economic costs and benefits of applying the materials-by-design concept to catalysts were estimated. Catalysts are of particular interest because of the competitive challenge from Japan, West Germany, and France. Initial estimates developed in this study reveal a potential capital cost savings of $31 billion and an operating cost savings of $69 billion for chemical and petroleum refining plants over a 15-year period. The findings of this study substantiate the claim that a major US effort to enhance materials-by-design technology is warranted, at least for catalyst materials. In addition, this technology would ensure pre-eminence by the US industry.

9317 (CE-Trans—8207) Investigation into high cement concrete containing PFA. van der Wegen, G. (Central Electricity Generating Board, London (UK). Translations Section; INTRON B.V., Maastricht (Netherlands)). [1986]. Translation of Report No. 85024, January 1985. 53p. NTIS (US Sales Only), PC A04. File Number DE87900245.

An investigation was carried out to determine whether high cement concrete containing pulverized fuel ash (PFA) can offer, in addition to the very good workability, yet further specific advantages, namely development of strength, durability and resistance to chemicals. The investigation showed that the replacement of cement by PFA results in a lower water requirement, with the workability remaining unchanged, a slight reduction in the compressive strength, and an increase or decrease in the apparent porosity and permebility. A further addition of PFA leads to a lower or higher water requirement (depending on the amount of PFA used), with the workability remaining the same, a slight increase in compressive strength and an increase or decrease in apparent porosity and permeability (depending on the amount of PFA used). The effect of the PFA on the carbonation behavior and on the resistance of the concrete to $MgSO_4$ was not clearly determined during this investigation.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 9079, 9550

9318 (AD-A—172107/5/XAB) Evaluation of techniques for locating leaks in underground heat-distribution systems. Final report. Cooper, K.E.; Marsh; Segan, E.G. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1986. 20p. (CERL-TR-M—86/16). NTIS, PC A02/MF A01.

This report evaluates techniques for locating leaks in both conduit and carrier pipes of Class A prefabricated heat-distribution systems and shallow-trench systems. Techniques discussed include infrared spectroscopy, tracer gas, and acoustic emission. Available techniques were reviewed for their success in locating leaks at various sites and for the cost of equipment and services they require. The probability of locating leaks with a given technique is a function of many factors, including system configuration, type of leak, depth of system burial, and other environmental factors. A flowchart was developed to help select an appropriate leak location technique for a given system. Accuracy of leak location may be excellent in some cases, but poor in others. The factors that impede accurate leak location using the various techniques investigated are also discussed.

9319 (CONF-8609122—3) Applications of thermogravimetry in energy from solid waste research. Agrawal, R.K.; Helt, J.E. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003142.

From 15. North American Thermal Analysis Society conference; Cincinnati, OH, USA (21 Sep 1986).

Typically, MSW (municipal solid waste) consists of approximately 60% combustible organics such as: paper, newsprint, packing material, wood wastes, yard clippings, food wastes, plastics and textiles. The remainder is comprised of moisture, glass, metals, and other inorganic wastes. Thermochemical processes are promising methods for rapidly converting MSW to useful fuels. However, the composition of MSW varies from place to place and on a daily basis. Therefore, any conversion facility will need to continually adjust its operating conditions with changing feed composition to optimize the product yields. In this paper the use of TG, DTA and DSC to obtain the thermal characteristics of the feed and aid in adjusting the operating conditions of a conversion unit are discussed. TG analyses of some MSW components are presented and their thermokinetic mechanisms are discussed.

9320 (DOE/CE/26525—T1) City of Vineland, New Jersey district heating/cooling feasibility study: Final report. (Burns and Roe, Inc., Oradell, NJ (USA)). Nov 1986. Contract FG01-85CE26525. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002718.

This study assesses the available heat load, determines the available heat from the heat sources, develops a distribution network, develops a system implementation plan, assesses the environmental impacts, addresses institutional issues, and analyzes the economics of the conceptual system.

9321 (GKSS—86/E/24) Kuwait reverse osmosis test facility - a documentation of membrane performance. Kaschemekat, J.; Hilgendorff, W.; Hassan, A.M.; Al-Jamal, K.; Malik, A.L.A. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1986. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750800.

This report describes the seawater reverse osmosis experimental plant based on the GKSS plate module system and the evaluation of experiments carried out under Gulf seawater conditions in Kuwait utilizing different membrane brands. Seawater pretreatment was limited to simple filtration and pH adjustment. Two of three tested non-cellulosic thin film composite membranes (TFC) gave better performance than all the seven cellulose acetate membranes (CA). The work was carried out in Kuwait under the joint agreement between the GKSS Research Centre, Federal Republic of Germany, and the Kuwait Institute for Scientific Research (KISR) and the Water Resources Development Centre (WRDC), Kuwait.

3209 Education And Public Relations

9322 (PNL-SA—14018) Tracking consumer attitudes on energy conservation in the Pacific Northwest. Fang, J.M. (Pacific Northwest Lab., Richland, WA (USA)). May 1986. Contract AC06-76RL01830. 22p. (CONF-860818—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003171.

From American Council for an Energy Efficient Economy Santa Cruz summer study on energy-efficiency in buildings; Santa Cruz, CA, USA (17 Aug 1986).

Measurement of consumer attitudes and other characteristics allows for the segmentation of the market in a variety of ways to aid in the development and implementation of effective energy conservation programs in the residential sector. Pacific Northwest Laboratory has been conducting marketing analyses for energy conservation activities in the Pacific Northwest for Bonneville Power Administration since 1983. Work completed to date includes a regionwide telephone survey of consumer attitudes conducted in 1983 and several studies characterizing and analyzing specific market segments. In late 1985, a second regionwide consumer attitudes survey was conducted and analyses of the survey data are being conducted. Purpose of this paper is to present the results of a tracking analysis of the changes in consumer attitudes between 1983 and 1985. Consumer understanding and perceptions of energy conservation and other issues are explained first. This is followed by discussions on perceptions of energy institutions and other entities. Results concerning past and potential energy conservation actions, financing, and impacts of energy conservation investments are then presented and a simple scheme of market segmentation is explored.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

9323 **Fuel evaporation apparatus and method.** Earl, G. US Patent 4,622,944. 18 Nov 1986. Filed date 1 Aug 1985. v.p.

This patent describes an evaporator apparatus for use in the fuel supply system of an internal combustion engine, comprising: (a) housing means including an opening closed by removable cover means; (b) inlet means for admission of fuel to chamber means, the inlet means comprising pore means provided at spaced locations about the chamber means; (c) thermal disc means mounted in the chamber means, the thermal disc means being controllably heated whereby fuel from the inlet means impinging upon the thermal disc means is vaporized, the thermal disc means including a plurality of holes each extending completely there-through; (d) outlet means for evacuating vaporized fuel from the chamber means; and (e) the cover means defining a trough having an inlet port connectable to a supply of fuel, the pore means communicating the trough with the chamber means.

9324 **Fuel injection apparatus for internal combustion engines.** Nozaki, S.; Yamada, K.; Kushida, T. (to Diesel Kiki Co., Ltd.). US Patent 4,622,942. 18 Nov 1986. Filed date 30 Dec 1985. v.p.

This patent describes a fuel injection apparatus including a fuel injection pump which is adapted to carry out fuel intake, fuel pressurization, fuel injection and draining of cut-off fuel in accordance with the reciprocal movement of a plunger. The plunger is driven in synchronization with the rotational operation of an internal combustion engine. The apparatus comprises: a first storing means for temporarily storing cut-off fuel drained at the same time of the termination of the fuel injection; a second storing means of changeable volume for temporarily storing fuel for intake, the second storing means having a movable member which is movable in response to the quantity of fuel introduced therein; a detecting means for producing a detection signal relating to the amount of fuel stored in the second storing means; a clamping means responsible to an electric signal for clamping the movable member; and a signal producing means for producing at least one condition signal relating to the operating condition of the internal combustion engine.

9325 **Porting arrangement for internal combustion engine.** Yoshikawa, M. (to Yamaha Hatsudoki Kabushiki Kaisha, Iwata). US Patent 4,622,940. 18 Nov 1986. Filed date 14 Mar 1985. v.p.

This patent describes a valve and porting arrangement for the combustion chamber of a four-cycle internal combustion engine having at least three separate valve seats communicating with the combustion chamber. The arrangement also has a valve means for controlling the flow through the valve seats, and at least three passages extending separately from respective of the valve seats. The passages merge smoothly into a single passage extending to and having only a single inlet opening formed on an outer face of the component of the engine in which the passages are formed. The single passages have a generally symmetrical, non-circular configuration.

9326 **Engine combustion control with ignition timing by pressure ratio management.** Matekunas, F.A. (to General Motors Corp., Detroit, MI). US Patent 4,622,939. 18 Nov 1986. Filed date 28 Oct 1985. v.p.

This patent describes an ignition timing control for an internal combustion engine of the type having a combustion chamber, a rotating crankshaft and ignition apparatus for the combustion chamber. The control comprises in combination: means responsive to combustion chamber pressure to generate signals for a combustion event indicating combustion pressure and motored pressure at a first predetermined crankshaft rotational angle during combustion and at a second predetermined crankshaft rotational angle at substantially complete combustion; means effective to compute, from the signals, first and second pressure ratios of combustion pressure to motored pressure at the first and second crankshaft rotational angles, respectively; and means responsible to the last means to adjust the ignition timing to maintain a predetermined ratio between the first and second pressure ratios each decreased by one, whereby combustion timing is controlled in closed loop to an MBT value.

9327 **Low level lubricating oil detector.** Janisch, D.G. (to Briggs and Stratton Corp., Wauwatosa, WI). US Patent 4,622,935. 18 Nov 1986. Filed date 13 Nov 1985. v.p.

This patent describes a low level lubricating oil detecting system for an intenral combustion engine, comprising an oil reservoir in the engine to contain lubricating oil, a tubular member disposed in the reservoir. The lower end of the tubular member has an aperture disposed at a predetermined minimum oil level and the tubular member has an upper end. A housing defines a chamber, the upper end of the tubular member communicating with the chamber. A pressure transducer means encloses the chamber and is operably connected to the engine. Pressure pulsations in the reservoir when the oil level recedes beneath the predetermined minimum level are transmitted through the tubular member and the chamber to flex the pressure transducer means and thereby discontinue operation of the engine.

9328 **Crankshaft structure of two-cycle internal combustion engine.** Oyama, K. (to Honda Giken Kogyo Kabushiki Kaisha, Tokyo). US Patent 4,622,934. 18 Nov 1986. Filed date 25 Sep 1984. v.p.

This patent describes a crankshaft structure in a two-cycle internal combustion engine comprising a crank web and a crank journal rotatably supported in a crank case by a bearing means. The crank web includes a supporting part having a central bore for receiving the crank journal press-fit therein. The supporting part has a reduced outer diameter portion disposed adjacent the bearing means supporting the crank journal and at an axial position overlying a press-fit part of the crank journal in the central bore of the crank web supporting part. The reduced outer diameter portion of the supporting part has a sealing member disposed on the outer periphery thereof.

9329 **Lubricant feed system for use in the journal of a crankshaft.** Fukuo, K.; Yamamoto, H. (to Honda Giken Kogyo Kabushiki Kaisha, Tokyo). US Patent 4,622,933. 18 Nov 1986. Filed date 13 Dec 1985. v.p.

This patent describes a lubricant feed system for a journal of a crankshaft comprising first bearing supporting portions formed in a cylinder block. Each has a peripheral surface, second bearing supporting portions formed in caps. Each has a peripheral surface, first bearings arranged on the first bearing supporting portions, second bearings arranged on the second bearing supporting portions, and at least one oil main gallery. Annular grooves are circumferentially formed at the respective first and second bearing supporting portions. Oil grooves are circumferentially formed at the inner peripherial surfaces of the first bearings and apertures are formed at the first bearings to communicate the annular grooves with the oil grooves. The inner peripheral surfaces of the second bearings are made flat wherein the oil main gallery is communicated with the annular grooves at the second bearings respectively.

9330 **V-crankarm.** Giocastro, J.; Giocastro, P.; Giocastro, J. US Patent 4,622,932. 18 Nov 1986. Filed date 2 Aug 1983. v.p.

This patent describes a crankarm system for translating a force of a piston of an internal combustion engine into rotating a crank shaft, comprising, in combination: a crank pin connected to the piston, a crankarm, the crankarm having a crank pin arm portion and a crank shaft arm portion, the crank pin arm portion having a crank pin end connected to the crank pin and an opposed connecting end. The crank shaft arm portion has a crank shaft end portion and an opposed connecting end, the crank pin arm portion and the crank shaft arm portion being connected at a first angle at the connecting ends, the crank arm also having another crank pin arm portion and another crank shaft arm portion, the another crank pin arm portion having a crank pin end and opposite connecting end and the another crank shaft arm portion having a crank shaft end portion and an opposite connecting end opposed to the crank shaft end portion. The another crank pin arm portion is connected to the another crank shaft arm portion at an angle equal to the first angle and at the opposite connecting ends of another crank pin arm portion. The crankarm is configured in a shape of an S, with the crank pin arm portion and the another crank pin arm portion being opposed accurate end elements of the S and the crank shaft portion and the another crank shaft arm portion being a diametrical connecting element of the S.

9331 **Cooling system for automotive engine or the like.** Kubozuka, T. (to Nissan Motor Co., Ltd., Yokohama). US Patent 4,622,925. 18 Nov 1986. Filed date 5 Aug 1985. v.p.

This patent describes an internal combustion engine a structure subject to high heat flux, and a cooling system for removing heat from the structure, the cooling system comprising: a cooling circuit including: a coolant jacket formed about the structure and into which coolant is introduced in liquid form and permitted to boil; a radiator in which gaseous coolant is condensed to its liquid state; a vapor manifold communicating with the coolant jacket; a vapor transfer conduit leading from the vapor manifold to the radiator; separation means disposed in the vapor transfer conduit for separating liquid and gaseous coolant, the separation means including a drain port; a first conduit interconnecting the drain port and the coolant jacket; a drain pump disposed in the first conduit for inducting coolant from the drain port and for pumping same into the coolant jacket; a second conduit leading from the coolant jacket to the first conduit at a location intermediate of the drain port and the pump; and coolant return means for returning liquid coolant from the radiator to the coolant jacket in a manner to maintain the structure immersed in a predetermined depth of liquid coolant.

9332 **Exhaust control system for two-cycle engine.** Uchinishi, E. (to Kawasaki Jukogyo Kabushiki Kaisha). US Patent 4,622,928. 18 Nov 1986. Filed date 19 Mar 1985. v.p.

An exhaust control system is described for a two-cycle engine having at least one cylinder comprising: a main exhaust passage communicating with the cylinder; at least one auxiliary exhaust passage located laterally of the main exhaust passage circumferentially of a cylinder; and at least one rotary valve for adjustably opening and closing the auxiliary exhaust passage, the rotary valve being in the form of a shaft located parallel to a center line of the cylinder and interposed between the main exhaust passage and the auxiliary exhaust passage of rotation; wherein the auxiliary exhaust passage remains closed with respect to the main exhaust passage when the engine operates at a low engine speed range and is successively opened with respect to the main exhaust passage as the speed of the engine increases.

9333 **Hydrogen engine.** Lewis, W.N. US Patent 4,622,924. 18 Nov 1986. Filed date 20 Jun 1983. v.p.

This patent describes a power generation process wherein hydrogen is generated and used as engine fuel at substantially the same rates of generation and fuel utilization so that storage may be substantially avoided. The process comprises introducing water into a hydrogen-oxygen dissociation apparatus through valve means controlled by an engine throttle, dissociating hydrogen and oxygen in the dissociation apparatus by vaporizing the water to stream at a temperature of between 500°F. and 900°F. and contacting the steam with oil or resin, and feeding the hydrogen as it is generated into the engine for combustion therein.

9334 **Fuel compositions.** Zaweski, E.F.; Niebylski, L.M. (to Ethyl Corp., Richmond, VA). US Patent 4,623,360. 18 Nov 1986. Filed date 31 Oct 1985. v.p.

This patent describes a distillate fuel for indirect injection compression ignition engines containing, in an amount sufficient to minimize coking, especially throttling nozzle coking in the prechambers or swirl chambers of indirect injection compression ignition engines operated on such fuel, at least the combination of (i) organic nitrate ignition accelerator and (ii) a boronated phenolic compound which, when added to the fuel in combination with the organic nitrate ignition accelerator minimizes the coking.

9335 **Fuel compositions.** Zaweski, E.F.; Niebylski, L.M. (to Ethyl Corp., Richmond, VA). US Patent 4,623,362. 18 Nov 1986. Filed date 14 Nov 1985. v.p.

This patent describes a distillate fuel for indirect injection compression ignition engines containing, in an amount sufficient to minimize coking, especially throttling nozzle coking in the prechambers or swirl chambers of indirect injection compression ignition engines operated on such fuel, at least the combination of (i) organic nitrate ignition accelerator and (ii) an alkoxyalkanol which, when added to the fuel in combination with the organic nitrate ignition accelerator minimizes the coking.

9336 **Fuel compositions.** Zaweski, E.F.; Niebylski, L.M. (to Ethyl Corp., Richmond, VA). US Patent 4,623,361. 18 Nov 1986. Filed date 31 Oct 1985. v.p.

This patent describes a distillate fuel for indirect injection compression ignition engines containing, in amounts sufficient to minimize coking, especially throttling nozzle coking, in the prechambers or swirl chambers of indirect injection compression ignition engines operated on such fuel, at least the combination of (i) organic nitrate ignition accelerator and (ii) an organic phosphate which, when added to the fuel in combination with the organic nitrate ignition accelerator minimizes the coking.

9337 **Fuel compositions.** Zaweski, E.F.; Niebylski, L.M. (to Ethyl Corp., Richmond, VA). US Patent 4,623,363. 18 Nov 1986. Filed date 27 Nov 1985. v.p.

This patent describes a distillate fuel for indirect injection compression ignition engines containing, in an amount sufficient to minimize coking, especially throttling nozzle coking in the prechambers or swirl chambers of indirect injection compression ignition engines operated on such fuel, at least the combination of (i) organic nitrate ignition accelerator and (ii) a P/sub 2/S/sub 5/-terpene reaction product which, when added to the fuel in combination with the organic nitrate ignition accelerator minimizes the coking.

9338 **Performance of ceramic coatings on diesel engines.** MacAdam, S.; Levy, A. (Materials and Molecular Research Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 10 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Partially stabilized zirconia ceramic thermal barrier coatings were plasma sprayed on the valve faces and tulips and the piston crowns and cylinder heads of a locomotive size diesel engine at a designated thickness of 375μm (0.015"). They were tested over a range of throttle settings for 500 hours using No. 2 diesel oil fuel. Properly applied coatings performed with no change in composition, morphology or thickness. Improperly applied coatings underwent spalling durability was dependent on quality control of the plasma spray process.

9339 **Elevated temperature sliding wear of ceramic and hard metal coatings.** Levy, A.V.; Jee, N. (Materials and Molecular Research Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 29 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—). Contract AC05-84OR21400.

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

The unlubricated sliding wear behavior of several coating materials pairs that are candidates for the piston ring-cylinder wall in adiabatic diesel engines was determined at 25°, 425° and 730°C. Plasma sprayed metal bonded carbide composites on a washer component were worn in a 90° reversing oscillatory mode against a slurry deposited and impregnated mixed oxide on a wider surface disc at contact pressures from 0.17 to 14MPa. The morphology of the coatings was more important than composition in establishing wear rates. The ductile binder metal of the carbides was the dominant constituent on the wear interface of both the washer and the disc. Wear rates generally increased with temperature. A pre-test wear-in at 25°C and low contact pressure enhanced wear resistance of the plasma sprayed carbide materials at higher pressures and higher temperatures.

3302 External Combustion Engines

9340 (DOE/NASA/50112—67) **Progress of Stirling cycle analysis and loss mechanism characterization.** Tew, R.C. Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. Contract AI01-85CE50112. 17p. (NASA-TM—88891; CONF-861002—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003288.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (27 Oct 1986).

An assessment of Stirling engine thermodynamic modeling and design codes shows a general deficiency; this deficiency is due to poor understanding of the fluid flow and heat transfer phenomena that occur in the oscillating flow and pressure level environment within the engines. Requirements for improving modeling and design are discussed. Stirling engine thermodynamic loss mechanisms are listed. Several experimental and computational research efforts now underway to characterize various loss mechanisms are reviewed. The need for additional experimental rigs and rig upgrades is discussed. Recent developments and current efforts in Stirling engine thermodynamic modeling are also reviewed.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 9282

3306 Vehicle Design Factors

9341 (CONF-8608136—1) **Measuring the benefits and costs of ceramic turbochargers: the perspective from the driver's seat.** Larsen, R.P. (Argonne National Lab., IL (USA)). Aug 1986. Contract W-31-109-ENG-38. 10p. NTIS, PC A02. File Number DE87001519.

From Society of Automotive Engineers conference; Los Angeles, CA, USA (4 Aug 1986).

The development of high-strength structural ceramics has many implications for advanced engine technology. Turbocharger rotors are an ideal early application of structural ceramics and are already in production in small volumes. Aside from the technical achievement this represents, what are the measurable benefits to empolying this new technology to production vehicles from the manufacturers and drivers point of view. This paper examines the results of a number of back-to-back performance tests of production vehicles equipped with ceramic and conventional turbochargers. The purpose was to more clearly quantify the benefits of this advanced turbocharger technology. A variety of acceleration tests were conducted by both independents and manufacturers. In addition, personal observations are included from more than 20,000 miles and a year of experience driving a production turbocharged car with a ceramic turbocharger. Benefits and costs of using this new technology in turbochargers are discussed, with emphasis on changes in vehicle behavior and related marketing implications.

9342 **Method of controlling ratio change in continuously variable transmission.** Nishioka, T.; Oshiage, K. (to Nissan Motor Co., Ltd., Yokohama). US Patent 4,622,867. 18 Nov 1986. Filed date 9 Mar 1984. v.p.

This patent describes a method of controlling a reduction ratio in a continuously variable transmission of a vehicle. The vehicle includes an engine drivingly connected to the continuously variable transmission and having a throttle which opens in degrees, and a control unit having a memory device, the method comprising the steps of: storing a ratio change allowable range in the memory device having a maximum reduction ratio and a minimum reduction ratio; preparing data containing various reduction ratios including reduction ratios falling outside of the ratio change allowable range; determining a desired reduction ratio from the data and generating a desired reduction ratio indicative signal; and determining an actual reduction ratio in the continuously variable transmission and generating an actual reduction ratio indicative signal.

9343 **Apparatus for controlling continuously variable transmission when accelerating from low speeds.** Itoh, H.; Takada, M. (to Toyota Jidosha Kabushiki Kaisha, Toyota). US Patent 4,622,865. 18 Nov 1986. Filed date 11 Jul 1984. v.p.

This patent describes an apparatus for controlling a continuously variable transmission. The apparatus includes a desired engine speed setting means for setting the desired engine speed as a function of running parameter and control means for controlling a continuously variable transmission such that an actual engine speed becomes a desired engine speed, comprising: An acceleration requisition detecting means for detecting the requisition of vehicle acceleration; an acceleration detecting means for detecting the vehicle acceleration; and a speed ratio reducing means for reducing the speed ratio of the continuously variable transmission when the vehicle acceleration is small while the vehicle acceleration is demanded.

9344 **Encased engine generator.** Nashimura, A.; Yoshii, M.; Yasui, S. (to Yanmar Diesel Engine Co., Ltd., Chaya). US Patent 4,622,923. 18 Nov 1986. Filed date 25 Feb 1985. v.p.

This patent describes an encased engine generator having an air-cooled engine and a generator housed in a case approximately structured in a rectangular parallelepiped having a front and a rear. A fuel tank is provided along the upper surface of the case. An engine having a cooling fan at its side is disposed within the case beneath the fuel tank, and a generator interlocked with the engine is disposed at the downstream side of the cooling air from the cooling fan. A silencer is disposed in a rearward space between the fuel tank and generator so that its outer circumference may be cooled by part of the cooling air. Operating parts such as engine operation knob necessary for operation and maintenance are provided on the front face wall of the case which encloses the remaining cooling air while cooling and exhaust discharge occurs from the rear, away from the operator.

9345 **Oxygen sensor monitor.** Bienkowski, J.V. (to Allied Corp., Morristown, NJ). US Patent 4,622,844. 18 Nov 1986. Filed date 22 Apr 1985. v.p.

This patent describes a portable monitor for use in a vehicle to check the operation of an oxygen sensor comprising: a housing having a rectangular body with a projection extending therefrom, the projection having a wall with a slot therein; a first probe having a first end that extends through the projection and a second that extends through the wall; a spring connected to the wall for urging the second end of probe toward the wall; a second probe having a portion that extends through the projection; a receptacle connected to a source of electrical voltage and an electrical ground, the projection being connected to the receptacle, the spring urging the first probe into electrical contact with the electrical voltage and the second probe engaging the receptacle and thereby being connected to the electrical ground; regulator means located in the rectangular body connected to the source of electrical voltage to establish a stable source of electrical voltage; a first indicator light connected to the regulator means and electrical ground through the second probe for informing an operator of the availability of stable electrical voltage; buffer means connected to the regulator, electrical ground and oxygen sensor for generating an output signal corresponding to an operational signal developed in the oxygen sensor; means for comparing the output signal with a reference signal to develop an indicator signal; and a second indicator light connected to the regulator and responsive to the indicator signal for providing an operator with an indication of the functioning of the oxygen sensor.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 9333, 9334, 9335, 9336, 9337

35 ARMS CONTROL

3501 Policy, Negotiations, And Legislation

9346 (DOE/DP/00789—T253) **Restricting production of fissionable material as an arms control measure. An updated historical overview.** Taylor, J.M. (Sandia National Labs., Albuquerque, NM (USA)). May 1986. Contract AC04-76DP00789. 76p. (DF—61980). NTIS, PC A05/MF A01; GPO Dep. File Number DE87003248.

One of the earliest proposals for control of nuclear weapons was to restrict or control production of fissionable material. This paper reviews the evolution of this proposal, known as cutoff, from its initial appearance in 1946 to 1985.

9347 (DOE/NBM—7003247) **United States' arms control obligations under the NonProliferation Treaty.** (USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of International Security Affairs). 27 Jun 1986. 16p. (DF—61980). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003247.

Article VI of the 1986 Non-Proliferation Treaty obligates the nuclear weapon states party to the Treaty "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race, ...to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." The preamble to the NPT refers to the 1963 Limited Test Ban Treaty "determination...to achieve the discontinuance of...explosions." These provisions are interpreted by many non-nuclear weapon states party to the NPT as an obligation of the nuclear weapon states party to the treaty to pursue a comprehensive test ban (CTB). However, a review of the history of the NPT negotiations and US ratification proceedings makes clear that Article VI imposes no legal obligation on the US to pursue a CTB. The United States did not make a one-to-one correspondence between Article VI and any specific arms control measure; to the contrary, the United States argued successfully that such a connection (to any specific measure) would be pernicious to the attempt to achieve agreement on the NPT. This interpretation held through the negotiations and ratification proceedings. However, a majority of NPT signatories assert that Article VI does indeed imply a commitment to a CTB. In the absence of progress on other arms control measures, which would relieve the pressure for a CTB, this interpretation creates a political problem for the US and could threaten the NPT regime in the future. These problems emphasize the need for the United States to more clearly explain its compliance with Article VI and to develop a long-term strategy that will permit necessary testing while assuring the survival of the NPT regime in effective form.

3503 Verification

REFER ALSO TO CITATION(S) 9880

36 MATERIALS

9348 (CONF-840218—9) **Interaction of microstructure and mechanism in defining K/sub Ic/, K/sub Iscc/ or DELTA K/sub th/ values.** Gerberich, W.W. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). 1984. Contract AC02-79ER10433. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002535.

From 113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers; Los Angeles, CA, USA (26 Feb 1984).

Microstructural features interacting with crack tips may produce an irregular crack front because of contiguous microbranching, microfissuring or discontinuous microcracking. All of these may leave behind ligaments which contribute a process zone. Elastic-plastic models which include such microcrack zones are reviewed. It is proposed that such concepts provide a connective link between continuum and microstructural modeling of fracture behavior.

9349 (Juel-Spez—316, pp 6-9) **Critical X-ray and neutron diffraction at surfaces.** Wagner, H. (Muenchen Univ., Germany, F.R. Sektion Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9350 (SAND—86-1418C) **Simulation of atomistic crystal growth from the vapor phase.** Taylor, P.A.; Dodson, B.W. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. . 6p. (CONF-861207—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003154.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

We are in the process of studying strained-layer growth of two-dimensional Lennard-Jones lattices. To do so, we have developed three techniques, based on the Monte Carlo method and molecular dynamics, of simulating atomistic crystal growth from the vapor phase. The Monte Carlo method efficiently simulates the effects of long time-scale processes on the growth of strained-layer systems, but omits the transient dynamics of particle adsorption. The second technique, using molecular dynamics, gives results suggesting that epitaxial growth of strained-layer systems can occur on the picosecond timescales. However, this technique cannot capture the influence of the long time-scale processes on the growth process. In view of the shortcomings of the previous two techniques, a hybrid technique incorporating both the Monte Carlo method and molecular dynamics, has been developed. In principle, this technique models the transient dynamics of adsorption as well as the long term evolution of the system. This technique, however, is limited by artifacts that may only be eliminated by use of unwarrented amounts of supercomputer time.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 8883, 9030, 9060, 9086, 9093, 9093, 9097, 9100, 9105, 9105, 9118, 9118, 9119, 9120, 9128, 9129, 9144, 9154, 9339, 9339, 9447, 9593, 9593, 9623, 9624, 9647, 9936, 10435, 10604, 10609, 10667

9351 (AD-A—170049/1/XAB) **Mechanisms for the electroplastic effect in metals.** Sprecher, A.F.; Mannan, S.L.; Conrad, H. (North Carolina State Univ., Raleigh (USA). Dept. of Materials Engineering). 1986. 16p. NTIS, PC A02/MF A01.

The effects of high-density d.c. current pulses (1,000 A/sq mm for 60 microseconds) on the flow stress of a number of polycrystalline metals (Al, Cu, Ni, Fe, Nb, W and Ti) tested in uniaxial tension at 300 K were investigated with the objective of determining the mechanisms responsible for the concurrent load drops. Both reversible and irreversible (plastic) strains contributed to the load drops. The major component of the reversible strain was the thermal expansion due to Joule heating; skin, pinch, and magnetostrictive effects were of less importance. An analysis of the plastic-strain contribution to the load drops suggested that it resulted from the enhancement of dislocation mobility due to the action of drift electrons. Employing the thermally activated plastic flow concepts, the electron wind push coefficent B/sub ew/ could be determined for Al and Cu and was found to be of the order of 10,000 dyn-s/sq cm in accord with Roschupkin et al.'s theory. This value is in accord with the dislocation damping constant B determine by other techniques at approx. 300 K; it is, however, about an order of magnitude larger than is normally expected for the electron drag coefficient B/sub e/. In addition to the force exerted on dislocations by an electron wind, the anlaysis indicated that drift electrons also have a significant effect on one or more of the other parameters of the thermally-activated rate equation. Because of test-machine inertial effects, oscillations in the load occurred as it dropped in response to a current pulse.

9352 (AD-A—172488/9/XAB) Stress state and hydrogen-related fracture. Technical report. Koss, D.A.; Yunchang. (Pennsylvania State Univ., University Park (USA). Dept. of Materials Science and Engineering). Sep 1986. 36p. (TR—2). NTIS, PC A03/MF A01.

The influence of externally imposed stress state on the hydrogen-assisted fracture of metals is reviewed. Independent of any transport process that may result in hydrogen accumulation, the effects of stress state are to accelerate the hydrogen-related fracture processes with increasing triaxiality of stress state. The magnitude of the intrinsic sensitivity of hydrogen embrittlement to stress-state effect depends on the mechanism of embrittlement. The behavior of selected hydride as well as non-hydride-forming alloy systems is reviewed.

9353 (BNL—38541) Stress-corrosion crack growth by film-induced cleavage: some kinetic considerations. Newman, R.C.; Kim, J.S.; Sieradzki, K. (Brookhaven National Lab., Upton, NY (USA); University of Manchester Inst. of Science and Technology (UK). Corrosion and Protection Centre). 1985. Contract AC02-76CH00016. 10p. (CONF-8510160—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001369.

From ASM metals congress/TMS-AIME fall meeting; Toronto, Ontario, Canada (13 Oct 1985).

Transgranular stress-corrosion cracking (TGSCC) is now widely believed to be an essentially brittle process. The debate has shifted from the reality of the stepwise brittle fracture to the role of the environment in nucleating it. However, published correlations of "bare surface" electrochemical kinetics with the rate of TGSCC continue to be successful, notably for alpha brass in sodium nitrite solution. By comparing the results of two techniques (scratching and rapid straining) it is shown that the published bare surface anodic current densities in this system are at least one order of magnitude too high. The revised values fit neatly into the "film-induced cleavage" picture of TGSCC. In another system (alpha brass in cuprous ammonia solution) the anodic process is dezincification to a depth of 20 to 40 nm, followed by cleavage on the order of 1 μm; here the inadequacy of the anodic process to account for the cracking is more obvious. Some suggestions are made as to how one can incorporate cleavage into a kinetic model of SCC, with the objective of harmonizing film-induced cleavage with earlier electrochemical models.

9354 (BNL—38688) Where are the iron atoms and iron moments in RFe/sub n/Al/sub 12-n/. A Wigner-Seitz analysis. Melamud, M.; Bennett, L.H.; Watson, R.E. (National Bureau of Standards, Washington, DC (USA); Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 11p. (CONF-861111—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001459.

From Conference on magnetism and magnetic materials; Baltimore, MD, USA (17 Nov 1986).

The ternary compounds RFe/sub/n/Al/sub 12-n/ (n = 4, 5, 6; $ThMn_{12}$ structure) form an extensive family of alloys having complicated magnetic structures, with the rare earths (R) and Fe ordering at different temperatures. This magnetic ordering has been inferred from magnetization, Moessbauer and neutron diffraction measurements. X-ray results are in disagreement with the magnetic measurements as to which sites are occupied by the Fe, and it is not clear at which of the sites iron has the largest magnetic moment. Recently, we have suggested that the occurrence of a substantial magnetic moment at an atomic site in certain magnetic systems can be related to the occurrence of -72° disclination lines connecting atoms on this site. These disclinations are bond lines joining two near neighbor atoms which have six common nearest neighbors and can be recognized by a six-fold face appearing on the Wigner-Seitz polyhedra of the two atoms. The Wigner-Seitz construction and its use in the analysis of this and related problems is presented.

9355 (CEA-CONF—8445) Brittle and ductile rupture of 16MND5 steel. Irradiation effect. Al Mundheri, M.; Soulat, P.; Pineau, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Jun 1986. 15p. (In French). (CONF-8606228—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750762.

From International seminar on local approach of rupture; Moret-sur-Loing, France (3 Jun 1986).

Toughness tests have been made on 16MND5 steel (A508Cl3 steel) - before and after irradiation at 290°C (3.10^{19} n/cm^2, E > 1 MeV). It is shown that toughness is lowered following the irradiation and that it is a decreasing function of the thickness of the test pieces. In parallel, tests on three geometries of entailed specimens, prepared in the non-irradiated material, have been made at different temperatures to apply the methodology of local approach of ductile-brittle rupture.

9356 (CEA-R—5352) Study of surface modification of alloys by photoelectron spectroscopy and neutron activation analysis: application to the study of a gold-copper alloy. Guittet, M.J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 128p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750720.

Ion erosion etching is generally used to prepare surfaces for electron spectroscopy (ESCA and AES). During etching, selective interactions occur between ions and various elements from which the solid is constituted. The surface studied therefore undergoes modifications. Modifications of this type in the surface of a gold-copper alloy have been studied. The characteristics of an ion beam generated by a commercial gun without sweeping have been determined for low energy ions (beam shape, ion density distribution). These characteristics are then related to the effects observed (crater shape, etching rate). Neutron activation analysis has been used to determine the quantity of sputtered matter and subsequently the sputtering rate. Finally, a sequential analysis of sputtered matter (activation analysis) and studies of the characteristics of the eroded surface have confirmed the existence of a transient regime and enabled a correlation to be established between the composition of the surface layer for a stationary regime and the model used to describe the sputtering.

9357 (CEA-R—5357) Evolution of microstructures in nickel solid solution fatigued at high temperature: occurrence of an intragranular cavitation. Arnaud, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Jun 1986. 106p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750740.

We studied by T.E.M. the microstructures appearing in Nickel solid solution fatigued in push-pull between 0.4 Tm and 0.6 Tm (Tm=melting temperature), the maximum amplitude of stress was imposed: +- 100 MPa, three frequencies were used: 1.25 Hz, 2.5 Hz and 10 Hz. In Ni 6% at Ge the structure of dislocations evolves continuously with the number of cycles: homogeneous distribution of dislocations, cell structure, then development of sub-grains 5 times as big as the cell; these sub-grains are not stable, they break up into cells. This succession of structures suggests a cyclic evolution. The cavities appear for number of cycles greater than a threshold number depending on the temperature and the frequency. The cavities are not distributed uniformly, they are located in zone. According to the conditions of solicitation, the shape (equiaxe of small stick) and the distribution (uniform, in band, in crown) of the cavities fluctuate. This cavitation exists equally in other materials (Ni 4% at Si, Ni). This intra-granular cavitation has been observed in the same domain of temperatures as the domain of swelling in the same material under bombardment with ions Ni^+. Due to this similitude we searched for a segregation of solute (like the induced precipitation by irradiation) but this phenomenon did not occur with our experimental conditions.

9358 (CONF-860340—11) **Fundamentals of fracture and fatigue: a basis for alloy design.** Ritchie, R.O.; Gerberich, W.W.; Antolovich, S.D. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering; Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science; Georgia Inst. of Tech., Atlanta (USA). Fracture and Fatigue Research Lab.). 1986. Contract FG02-84ER45141;AC03-76SF00098. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002075.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Micro-mechanics and mechanisms describing fundamental aspects of failure by fatigue and fracture are examined from the perspective of alloy design of superior engineering metals and alloys. First, the physical basis for intrinsic fracture toughness in materials is derived through several micro-mechanical models for both brittle and ductile fracture, specifically for cleavage, microvoid coalescence and transitional fracture modes. Second, factors governing the rate of growth of fatigue cracks are described, with emphasis on the role of crack tip shielding mechanisms such as crack closure. Examples of the design of microstructures giving optimum resistance to fatigue crack propagation are presented, with emphasis on high temperature behavior. 113 refs., 32 figs.

9359 (CONF-861076—1) **Application of a grain-size-sensitive model to determine the effect of yttrium additions on the oxidation of nickel.** Hsu, H.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001680.

From Fall meeting of the Metallurgical Society of AIME; Orlando, FL, USA (5 Oct 1986).

The beneficial effect of active-element additions in metals and alloys on the formation of protective oxide scales is well known. Such additives will generally result in better scale adhesion and slower oxidation rates. In order to understand the role of active-element additions to the scale, a grain-size-sensitive model is proposed to determine the effect of yttrium on the grain boundary diffusion rate of nickel in NiO using oxidation kinetics and oxide grain size data that are available in the literature. It was found that the addition of yttrium to nickel decreases grain boundary diffusion of nickel in NiO at $T > 800°C$. At 900°C and 0.3% yttrium in nickel, the grain boundary diffusion rate of nickel in NiO can be reduced by a factor of 15. At $T < 700°C$, the addition of yttrium to nickel has no effect on the oxide grain boundary diffusivity. Good agreement was found between oxide grain boundary diffusivities calculated from this analysis and those determined by tracer-sectioning experiments.

9360 (CONF-861207—14) **Processing technology for nickel aluminides.** Sikka, V.K. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003000.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Ductile ordered intermetallic alloys of nickel aluminum or nickel aluminum chromium have been developed by optimized additions of boron. These alloys show excellent elevated temperature mechnical properties and corrosion properties. However, in order for the alloys to find use in various applications, they should be fabricable by either the well established or innovative processing technologies. This paper discusses the details of fabrication technology being pursued at ORNL. The processes being investigated include powder consolidation by extrusion, powder consolidation by capping, isothermal forging of powder compacted material, twin-roller casting to thin sheet followed by cold-rolling, direct casting rod from liquid, extrusion of billets made by argon-induction melting and electroslag remelting processes, injection molding of powders, and hot isostatic pressing of powders. Relative merits of each process are discussed. Mechanical properties data on products made by various processes are also presented and compared.

9361 (CONF-8308172—2) **Dislocation substructure and fatigue crack growth.** Gerberich, W.W.; Kurman, E.; Yu, W. (Minnesota Univ., Minneapolis (USA); California Univ., Berkeley (USA)). 1983. Contract AC02-79ER10433. 14p. American Society for Metals, Metals Park, Ohio 44073. File Number TI87002227.

From International symposium on mechanics of dislocations; Houghton, MI, USA (28 Aug 1983).

Dislocation cell networks are important features in cyclic strain hardening as well as crack tip advance. However, theoretical modeling of the later process in terms of discrete cell-wall structures is practically nonexistent. The present study addresses near threshold fatigue crack behavior with electron microscopy evidence of crack tip interactions with dislocation cells. This is followed by a computer simulation of slip-band, pile-ups interacting with an idealized cell network. Discrete analysis of the balance of forces with and without applied stress highlights the importance of the cell wall/dislocation pile-up arrangement. Based upon the relative importance of dislocation statics and dynamics, a threshold model which includes flow stress, cell size, test frequency, and strain-rate sensitivity is derived. Comparison to Fe-base data is qualitatively consistent.

9362 (CONF-8610163—1) **Determination of surfaces of constant inelastic strain rate at elevated temperature.** Battiste, R.L.; Ball, S.J. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001692.

From 5. annual workshop on turbine engine hot section technology; Cleveland, OH, USA (21 Oct 1986).

An experimental effort to perform special exploratory multiaxial deformation tests on tubular specimens of type 316 stainless steel at 650°C (1200°F) is described. One test specimen was subjected to a time-independent torsional shear strain test history, and surfaces of constant inelastic strain rate (SCISRs) in an axial/torsional stress space were measured at various predetermined points during the test. A second specimen was subjected to a 14-week time-dependent (creep-recovery-creep periods) torsional shear stress histogram SCISRs determinations made at 17 points during the test. The tests were conducted in a high-temperature, computer-controlled axial/torsional test facility using an Oak Ridge National Laboratory developed high-temperature multi-axial extensometer. The effort was successful, and for the first time the existence of surfaces of constant inelastic strain rate was experimentally demonstrated.

9363 (DOE/ER/45198—T2) **Structural and fast ion transport properties of glassy and amorphous materials: Progress report.** Whitmore, D.H.; Georgopoulos, P. (Northwestern Univ., Evanston, IL (USA)). Nov 1986. Contract FG02-85ER45198. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002528.

Research was done in two areas: structure and ion transport in Ag-Ge-Se glasses, and ionic conduction and diffusion in polymer electrolytes. NMR diffusion measurements were included. (DLC)

9364 (EUR—9730) **Hydrogen gas embrittlement of steels. Synthesis of a subtask of the CEC hydrogen energy programme (1975-1983).** Barthelemy, H.; Pressouyre, G. (Commission of the European Communities, Luxembourg). 1985. 177p. Commission of the European Communities, Luxembourg.

This report presents a synthesis of all the results obtained during eight years of R and D within the framework of contractual research of the hydrogen programme of the Commission of the European Communities, in the field of hydrogen embrittlement of steels. The themes treated include the effect of hydrogen purity, the influence of the surface status of the material, the testing techniques and the influence of testing parameters. The effect of the many parameters intrinsic to the material composition and of heat treatments are also described. The results obtained on fragilization of several standard steels by hydrogen are reported together with those on a few laboratory melts. A general analysis of the data is presented and recommendations on testing and selection methods and criteria of steels in relationship with specific utilization are advanced.

9365 (FRNC-TH—2139) **Study of corrosion of a carbon steel and its inhibition in systems of column head of atmospheric oil distillation.** Meric, C. (Toulouse-3 Univ., 31 (France)). 1983. 170p. (In French). Toulouse-3 Univ., 31, France.

Corrosion of carbon steel in aqueous solution of HCl and H_2S is examined. Tests are conducted with steel-ASTM-A214. Selection methods of organic compounds for corrosion inhibition are proposed. Electrochemical, gravimetric and metallographic methods for characterization of efficiency of corrosion protection are selected. Behavior of amines and mercaptans retained in the selection is examined. 116 refs.

9366 (INDC(NDS)—179/G) **Nuclear data for radiation damage estimates for reactor structural materials. Proceedings of an IAEA consultants' meeting held in Santa Fe, New Mexico, USA, 20-22 May 1985.** Piksaikin, V. (ed.). (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jun 1986. 186p. (CONF-8505321—). NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263.

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

The IAEA Consultants' Meeting on Nuclear Data for Radiation Damage Estimates for Reactor Structural Materials was convened by the IAEA Nuclear Data Section in Santa Fe, New Mexico, USA from 20-22 May 1985. The meeting was attended by 17 participants from 10 countries and 2 international organizations. The main objectives of the meeting were to review the status of displacement cross sections and the requirements for nuclear data needed for radiation damage estimates in reactor structural materials, and to develop recommendations for future activities in this field. This publication contains the text of all the papers prepared especially for this meeting including the conclusions and recommendations worked out during the meeting.

9367 (INDC(NDS)—179/G, pp 19-22) **Experience with the use of the ^{93}Nb(n,n')^{93}sup(m)Nb reaction for routine monitoring of materials irradiation experiments.** Thomas, A.F. (Rolls-Royce Ltd., Derby, UK). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

The use of the ^{93}Nb(n,n') reaction with long half life and low energy threshold holds out much promise as a routine fast neutron and hence damage monitor in materials irradiation dosimetry. Recent UK experience in a large and varied number of metallurgical irradiation experiments using this reaction in conjunction with more conventional activation monitors suggests that there may still be systematic discrepancies in the nuclear data associated with this reaction, particularly in the domain of the reaction cross sections. Experience has shown that previous practical difficulties using this reaction can be simply overcome and therefore impetus should be given quickly to improving our knowledge of its cross section. 10 refs, 1 tab.

9368 (INDC(NDS)—179/G, pp 23-30) **Comparison of predicted and measured Charpy NDT shifts at Krsko Nuclear Power Plant.** Najzer, M.; Arnuga, V.; Glumac, B.; Jencic, I.; Kodeli, I.; Loose, A.; Remec, I. Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

Presented are results of impact testing of Charpy specimens irradiated in Krsko Nuclear Power Plant, a 632 MWe PWR, during the first two fuel cycles. Neutron fluence E > 1 MeV at specimen position was between 7 to $9.10^{18}cm^{-2}$ depending on position in the capsule. Neutron fluence was calculated by the transport code DOT and then adjusted, together with the measured reaction rates of neutron monitors, using the code STAYSL. Shift in the Charpy V-notch curve for irradiated materials relative to that of unirradiated material was compared with the shifts calculated from different models. 7 refs, 4 figs, 4 tabs.

9369 (INDC(NDS)—179/G, pp 45-60) **Activation and He-production in fusion reactor structural materials, simulated at a neutron irradiation facility at the JRC-Ispra Cyclotron.** Forte, M.; Maranzana, C.; Jung, P.; Galletti, E. (Commission of the European Communities, Ispra, Italy. Joint Research Centre; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung; Politecnico di Milano, Italy). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

The characteristics are presented of a neutron source operating at the JRC-Ispra Cyclotron, where the 7Li(p,n) reaction in a thin Li target is used to simulate fusion reactor spectra including a strong quasi-monochromatic 14 MeV component. A particular scintillation spectrometry method, used to determine the neutron energy distribution and intensity, is described and dosimetry problems are discussed. Experiments for the study of neutron activation and He-production are presented, with preliminary results for pure Ni, and for AISI 316 and AMCR 33. 9 refs, 11 figs, 1 tab.

9370 (INDC(NDS)—179/G, pp 67-78) **Nuclear data for high-energy neutron transport and damage calculations in steel.** Prillinger, G. (Stuttgart Univ., Germany, F.R. Inst. fuer Kernenergetik und Energiesysteme). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

For simulating neutron damage in materials needed for the design of fusion reactors the application of high-energetic neutrons from generators and spallation sources up to 1000 MeV is planned. To characterize the radiation damage environment of the various facilities the neutron spectra, primary displacement damage and gas-production rates must be determined. In contrast to energies below 20 MeV, only few evaluated data sets are available for high energy neutrons. Transport cross-section libraries like HILO or LANL have been compared with a cross-section set calculated with the HETC code. To describe accurately the high scattering anisotropy essential improvements have been performed in the ANISN transport code. To generate total and differential damage parameters in the medium energy range from 20 - 50 MeV a special code has been written handling also cascade-reactions. For iron and the main additional elements of stainless steel the energy transfer to the heavy recoils and light emitted particles has been calculated. 16 refs, 10 figs, 1 tab.

9371 (INIS-mf—10512, pp 63) **Temperature dependence of the paramagnetic neutron scattering in isotropic ferromagnets near Tsub(c).** Folk, R.; Iro, H. (Johannes Kepler Univ., Linz, Austria. Inst. fuer Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9372 (INIS-mf—10512, pp 29) **Positron annihilation rates by the density functional formalism.** Sormann, H.; Obermayr, W. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9373 (INIS-mf—10512, pp 42) **Hydrogen-induced change of the magnetic order states in intermetallic compounds.** Wiesinger, G.; Hilscher, G. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9374 (INIS-mf—10512, pp 47) **Potential electron emission from a tungsten surface bombarded with slow hightly charged ions.** Fehringer, M.; Varga, P.; Winter, H.; Delaunay, M.; Geller, R. (Technische Univ., Vienna, Austria. Inst. fuer Allgemeine Physik; DRFG-PADSI, C.E.N. de Grenoble, France). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9375 (INIS-mf—10512, pp 59) **Magnetic and specific heat measurements in UXT compounds (X = Al, Ga, Sn; T = Co, Ni, Ru, Rh, Ir, Pt).** Hilscher, G.; Pillmayr, N.; Schmitzer, C.; Sechovsky, V. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik; Univ. Praha, Czechoslovakia. Faculty of Mathematics and Physics). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9376 (INIS-mf—10516, pp 86-92) **Annealing fracture of welded joints.** Hrivnak, I. (Vyskumny Ustav Zvaracsky, Bratislava, Czechoslovakia). Sep 1985. (In Slovak). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700261. (CONF-8510384—Pt.1).

From 5. national seminar on creep and creep fracture; Kuparovice, Czechoslovakia (21 Oct 1985).

Annealing cracks are produced in annealing of welded pressure vessels made of low-alloy steels of the CrMo, CrMoV or CrNiMo types. Microstructure study using an electron microscope can show the production of cavities, their clustering, up to the propagation of microscopic and macroscopic cracks. This cracking is affected by the basic chemical composition and by the so-called surface-active elements, such as impurities of S, P, Sb, Sn, Pb, etc. There are a number of laboratory tests for determining the susceptibility of steels to annealing cracks; most frequently, the accelerated creep test and the tensile test in the annealing temperature range are used. Crack formation in the heat-affected zone under the austenitic overlay is a special case of annealing cracking. Susceptibility to this type of crack formation is detected using a test consisting in the simulation of temperature deformation effects of overlaying.

9377 (INIS-mf—10516) **Creep and creep fracture. Conference proceedings.** (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie). Sep 1985. 27p. (In Czech and Slovak). (CONF-8510384—Pt.1). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700261.

From 5. national seminar on creep and creep fracture; Kuparovice, Czechoslovakia (21 Oct 1985).

Between October 21 and 24, the fifth national seminar on creep and creep fracture took place in Czechoslovakia. The seminar proceedings (issued in two volumes) contain 4 review papers and 27 original communications. 4 original communications were inputted in INIS. They deal with: creep of ferritic steels used for the manufacture of fast reactor steam generators; annealing fracture of pressure vessel welded joints; pure zirconium creep; plastic deformation of zirconium alloys for nuclear reactor fuel elements.

9378 (INIS-mf—10516, pp 39-44) **Secondary precipitation of vanadium carbides during creep of ferritic 9-12% Cr steels.** Gemperle, A.; Riman, R.; Foldyna, V.; Jakobova, A. (Vyzkumny Ustav Hutnictvi Zeleza, Karlstejn, Czechoslovakia; Vitkovicke Zelezarny Klementa Gottwalda, Ostrava, Czechoslovakia. Vyzkumny Ustav Metalurgicky). Sep 1985. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700261. (CONF-8510384—Pt.1).

From 5. national seminar on creep and creep fracture; Kuparovice, Czechoslovakia (21 Oct 1985).

An experimental proof was given of precipitation of very fine dispersions of vanadium carbides and nitrides in the creep of ferritic steels containing ca. 9% chromium. In addition to $M_{23}C_6$ carbides, these carbides and nitrides contribute to the dispersion hardening of said steels used for the manufacture of fast reactor steam generators. Steel specimens containing 9.1 to 9.5% chromium and 0.1 or 0.3% vanadium were studied. The basic heat treatment involved 950 degC/0.5 h hardening in the air and 750 degC/24 h tempering in the air. Creep tests were performed at a temperature of 575 degC and stress of 70 to 160 MPa over 900 to 73,000 hours. Selection electron radiograms were obtained of the individual components in the replicas of all specimens. Fine platelet-type precipitates were observed in addition to $M_{23}C_6$, the main precipitation phases in martensite and bainite. In part of the precipitates, the measurement of the lattice parameter showed the structure to be VCsub(0.93). During creep, precipitates occur of a composition of VNsub(0.63). The measured volume densities and mean sizes of the precipitates are tabulated.

9379 (INIS-mf—10517, pp 223-229) **Viscous creep of zirconium in homologous temperature 0.35 to 0.48.** Fiala, J.; Kloc, L.; Cadek, J. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie). Sep 1985. (In Czech). NTIS (US Sales Only), PC A02/MF A01. File Number DE87780056. (CONF-8510384—Pt.2).

From 5. national seminar on creep and creep fracture; Kuparovice, Czechoslovakia (21 Oct 1985).

The diffusion and Harper-Dorn types were studied of pure zirconium-alpha creep, i.e., creep whose rate depends on the first power of stress. Sample preparation, grain size determination using metallographic analyses and the experimental technique for helicoid samples were described in earlier studies. More than 200 creep curves were analysed, i.e., time-dependent deformations at stress within 4×10^{-6} and 9×10^{-5} G (G -shear modulus of elasticity) and the grain size range 48 to 342 stress; extrapolation showed the existence of low (0.06 to 0.12 MPa) threshold stress with insignificant temperature dependence. Analysis of the measured relations shows that the Harper-Dorn creep takes place with the grain size exceeding 125 μm while with a smaller grain size the diffusion Coble-type creep is observed. A value of 1.06 +- 0.04 was found for the exponent of the power dependence of creep rate on stress. A comparison with the equation for steady-state creep rate theoretically derived by Ashby and Verrall gave a value of 123.9 +- 3.2 $kJ.mol^{-1}$ for the creep activation enthalpy, which is in excellent agreement with the value given by Sergent and Ashby for the activation enthalpy of diffusion across grain boundaries. The results obtained together with the results of an earlier study of dislocation creep made it possible to plot deformation mechanism maps.

9380 (INIS-mf—10517, pp 240-245) **Use of both empiricism and knowledge of underlying mechanisms in constructing constitutive equations.** Novak, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). Sep 1985. (In Czech). NTIS (US Sales Only), PC A03/MF A01. File Number DE87780056. (CONF-8510384—Pt.2).

From 5. national seminar on creep and creep fracture; Kuparovice, Czechoslovakia (21 Oct 1985).

The author's general experience is described with the construction of constitutive equations which, in some cases, allow to analyse relations between the course of deformation and damage leading to fracture. Two types of equations can be distinguished. In one, the scalar internal variable is related to the term "friction stress" introduced by Wilshire et al.; in the other it is related to the characteristic "drag stress" introduced by Gilman. The latter type is appropriate for zirconium alloys used in nuclear technology. Equations for nonirradiated zirconium alloys even in the simplest version use a great number of material parameters. The author modified constitutive equations set up for Zircaloy; he mainly altered the values of those parameters for which an effect of chemical composition can be expected. The confrontation of calculated and experimentally determined values of steady-state creep rate showed the suitability of the chosen technique. Compiling equations for irradiated material was a more difficult problem. The possibility is justified of generalizing equations for nonirradiated material and selecting one more internal variable characterizing the effect of fast neutron fluence. Thus, equations could be compiled for the technologically important temperature range of 423 to 573 K and for neutron fluence exceeding 10^{24} n/m_2.

9381 (INIS-mf—10517) **Creep and creep fracture. Conference proceedings.** (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie). Sep 1985. 15p. (In Czech). (CONF-8510384—Pt.2). NTIS (US Sales Only), PC A02/MF A01. File Number DE87780056.

From 5. national seminar on creep and creep fracture; Kuparovice, Czechoslovakia (21 Oct 1985).

Individual papers in this meeting have been abstracted separately.

9382 (IS-T—1244) **Proximity-induced Josephson effect and its application to heavy fermion superconductor UBe$_{13}$.** Han, S. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 131p. NTIS, PC A07/MF A01; GPO Dep. File Number DE87003049.

A new effect between a superconductor with superconducting transition temperature T/sub cs/ and a normal metal N (T/sub cn/) (or another superconductor with T/sub cn/<T/sub cs/) has been experimentally observed and theoretically explained. That is when S and N are brought together to form a weak link the Josephson effect can occur in this SN system even in the temperature range T/sub cn/<T<T/sub cs/, when the N side is in the normal state. The temperature dependence of the Josephson critical current I/sub c/(T) of the SN point contact junctions have been studied experimentally. The experiments have been performed on Ta/Mo, Ta/UBe$_{13}$ and Nb/Ta point contacts, etc. The theoretical model is based on the linearized Gor'kov equation (or linearized Ginzburg-Landau equation) combined with de Gennes boundary conditions. This model is applicable only in the vicinity of the T/sub c/ of the SN system. Thus, we studied I/sub c/(T) of the SN junctions near their T/sub c/. Good agreement between experimental data and theoretical result is obtained. Along with the recent discovery of the superconductivity in heavy fermion materials CeCu$_2$Si$_2$, UBe$_{13}$ and UPt$_3$ the old question of p-wave pairing superconductivity is raised again. Among these three heavy fermion superconductors UBe$_{13}$ is thought to be the best candidate for odd parity pairing. The proximity-induced Josephson effect is employed to investigate the pairing state of UBe$_{13}$. The results are found to favor an odd parity bulk superconducting ground state in UBe$_{13}$.

9383 (IS-T—1246) **Electron tunneling studies of Mo/sub 1-x/Re/sup x/: Enhancement of superconductivity by a resonance mode.** Shum, D.P.C. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 112p. NTIS, PC A06/MF A01; GPO Dep. File Number DE87003048.

It is well-known that a heavy impurity atom in a lattice of light atoms induces a lower frequency in-band resonance mode in the vibrational spectrum. The exact effect of such a mode on the lattice spectrum has not previously been reported and effects of such modes on superconductivity have not previously been described. Sputtered thin films of bcc Mo/sub 1-x/Re/sub x/, $0.2 < x < 0.4$, have been prepared for this study because the Re atom is almost twice as heavy as Mo. High quality MoRe/Al$_2$O$_3$/Pb tunnel junctions on these films have been made with an in situ deposited and subsequently oxidized thin Al layer as barrier. Three phonon peaks were observed directly in the dV/dI and d^2V/dI^2 curves. The $\alpha^2F(\omega)$ spectra, determined from the data through the Eliashberg theory of superconductivity, all show an anomalous low energy peak, in addition to the Mo-derived transverse and longitudinal phonon peaks. This peak appears near 14 MeV, in agreement with the Brout-Visscher theory and with neutron scattering data which first indicated the Re resonance mode in Mo/sub .85/Re/sub .15/. We show that the resonance mode contributes strongly to $\alpha^2F(\omega)$ and to strong coupling $\delta(=2\Delta/k/\text{sub } B/T/\text{sub } c/ - 3.53) > 0$. δ increases with λ/sub R/, the Re contribution to the electron-phonon coupling constant λ. The dependence of the anomalous softening and width of the resonance mode on λ/sub R/ fit the Yu-Anderson theory of local phonon screening by a Fermi gas of electrons treated as Tomonaga bosons. These results explain the low N(0), high T/sub c/ behavior of Mo/sub .6/Re/sub .4/.

9384 (Juel-Spez—316, pp 16-30) **Structure of expanding metals.** Winter, R.; Hensel, F.; Bodensteiner, T.; Glaeser, W. (Marburg Univ., Germany, F.R. Fachbereich 14 - Physikalische Chemie; Technische Univ. Muenchen, Garching, Germany, F.R. Fakultaet fuer Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The liquid metal structure is investigated by neutron diffraction up to 2000 K and 200 bar by determining the structure factor SCQJ for liquid cesium and rubidium. The rather complicated experimental equipment is described. (BHO).

9385 (Juel-Spez—316, pp 31-37) **Small-angle scattering from nickel domain structures.** Treimer, W.; Seifert, R. (Technische Univ. Berlin, Germany, F.R.; Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin, Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The domain structure in massive, rod-like <100>- and <110>-nickel monocrystals could be determined by neutron diffraction. The symmetry behaviour of the wall structure in <100> crystal of a misoriented sample can be explained by the influence of the magnetostrictive self-energy of the walls. (BHO).

9386 (Juel-Spez—316, pp 38-40) **Crystal fields in rare-earth mixed crystals.** Knopp, G.; Knorr, K.; Murani, A.P. (Mainz Univ., Germany, F.R. Inst. fuer Physik; Institut Max von Laue - Paul Langevin, 38 - Grenoble, France). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9387 (Juel-Spez—316, pp 47-52) **Local defect structure of fast diffusing deuterium in niobium.** Dosch, H.; Peisl, J. (Muenchen Univ., Germany, F.R. Sektion Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article reports on the investigation of the lattice distortions close to defects in Nb by means of coherent elastic-diffuse neutron scattering. (BHO).

9388 (Juel-Spez—316, pp 69-71) **Intermediate phase and dynamical properties of NiTi.** Muellner, M.; Tietze, H.; Renker, B. (Frankfurt Univ., Germany, F.R. Inst. fuer Kernphysik; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Nukleare Festkoerperphysik). Jun 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

By neutron inelastic scattering the acoustic phonon branches of the <110> and <111> directions have been investigated in the undistorted phase at 250°C and 150°C and further, at 65°C were premartensitic phenomena are already present. (orig./BHO).

9389 (Juel-Spez—316, pp 80-83) **Self-diffusion in simple liquid metals.** Morkel, C.; Glaeser, W. (Technische Univ. Muenchen, Garching, Germany, F.R. Fakultaet fuer Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9390 (Juel-Spez—316, pp 90-97) **Diffusion and tunneling of hydrogen in tantalum and niobium.** Wipf, H.; Magerl, A.; Potzel, U.; Voelkl, J.; Neumaier, K. (Technische Hochschule Darmstadt, Germany, F.R.; Institut Max von Laue - Paul Langevin, 38 - Grenoble, France; Technische Univ. Muenchen, Germany, F.R.; Bayerische Akademie der Wissenschaften, Garching, Germany, F.R. Walther-Meissner-Institut fuer Tieftemperaturforschung). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

Neutron diffraction experiments are reported for two different projects: the diffusion of hydrogen for high concentrations and tunneling and local diffusion of hydrogen. (BHO).

9391 (Juel-Spez—316, pp 234-239) **Magnetic properties of intermetallic rare-earth-Al$_3$ and rare-earth-Pd$_3$ compounds.** Leson, A.; Schelp, W.; Drewes, W.; Purwins, H.G.; Eckold, G.; Reichardt, W. (Muenster Univ., Germany, F.R. Inst. fuer Angewandte Physik; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung; Technische Hochschule Aachen, Germany, F.R. Lehrstuhl und Inst. fuer Kristallographie; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Angewandte Kernphysik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The aim of the present project is to get an understanding of the magnetic properties of rare earth compounds and to find a uniform atomic model. Therefore inelastic neutron diffraction has been used to determine the dispersion relations of the magnetic excitations and of the phonons. The magnetization and the magneto-crystalline anisotropy have been measured by a SQUID magnetometer. (BHO).

9392 (Juel-Spez—316, pp 250-256) **Small angle scattering and backscattering at magnetic structures.** Hoersten, H. v.; Anders, R.; Faisst, T.; Kournettas, P.; Stierstadt, K. (Muenchen Univ., Germany, F.R. Sektion Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The report comprises three different works: Small angle scattering at Co precipitations in Cu, dislocation scattering at Ni and backscattering for the measurement of critical materials properties of nickel. (BHO).

9393 (K/PS—817) **Preliminary evaluation of SF$_6$ conversion to SO$_2$ using existing chemical processing facilities.** Reiner, R.H.; VanLaethem, L.M.; Partin, H.B. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jun 1984. Contract AC05-84OT21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002316.

Conversion of SF$_6$ to SO$_2$ has been demonstrated using equipment compatible with existing pilot plant facilities. However, while reduction of SF$_6$ to iron sulfide has been demonstrated as an efficient, economic, and scalable process operation, oxidation of the sulfide to SO$_2$ causes serious compatibility problems in existing (and commonly used) reactor materials. Further characterization of the sulfide oxidation is necessary to determine the usefulness of this conversion process. 13 refs., 4 tabs.

9394 (KURRI-TR—249, pp 78-84) **Observation of cascade defects in metals and alloys induced by fission neutrons.** Shimomura, Yoshiharu; Kiritani, Michio; Yoshida, Hiroyuki. (Hiroshima Univ., Japan. Faculty of Engineering). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

For the study of the cascade defects in metals and alloys, the irradiation study with self metallic ions has been made. The simulation of the cascade defects induced by fission neutrons can be made by the self ions of energy from several tens to one hundred keV. The vacancy rich zone formed in the samples can be observed. These defects are easily formed in Au, Cu and Ag. In the case of irradiation at room temperature, the number of cascade defects depended on the fluence except Al and Fe, and the defects in Al and Fe were hardly observed in the case of small flux. The irradiation experiment by using fission neutrons was performed with bulk samples and polished samples. By comparing both samples, the mechanism to form the cascade defects and the contribution of interstitials may be presumed. In the case of Al, no cascade defect was observed. On the other hand, the irradiation experiment using 14 MeV neutrons from RTNS-2 has been made for the purpose of fusion reactor material study. It is necessary to make clear the correlation between the experiment of fission neutrons and that of 14 MeV neutrons.

9395 (KURRI-TR—249, pp 89-103) **Low temperature irradiation effects on plastic deformation in BCC metals.** Aono, Yasuhisa. (Kyushu Univ., Fukuoka, Japan. Research Inst. for Applied Mechanics). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

Low temperature electron beam experiment was carried out on high purity iron and molybdenum single crystals, and its effect on the plastic deformation was examined. As the characteristics of the irradiated iron below 77 K, remarkable softening occurred in all orientations. This phenomenon is based on the interaction of self interstitial atoms and screw dislocations, and the other features such as the absorption of interstitial atoms into screw dislocations and the slip on maximum shearing stress planes were shown. On the other hand, the aggregate of interstitial atoms formed by annealing showed the different plastic characteristics from those of interstitial atoms, and gave the results corresponding to respective stages of the electric resistance recovery curves. Regarding molybdenum, the transfer of its self interstitial atoms is near 40 K, therefore at 77 K, cluster is formed, and it largely affects abnormal slip, which is one of the features of the plasticity of molybdenum. The peculiar dependence of the yield stress on the crystalline orientation was shown. The property of the interaction of the aggregate of interstitial atoms formed and grown by the annealing from 77 K to 500 K with dislocations corresponded to the information of defects obtained by the X-ray research of Maeta, and the similarity to the aggregate of iron was observed.

9396 (KURRI-TR—249, pp 104-111) **Diffuse x-ray scattering from electron irradiated iron.** Tsukuda, Noboru. (Kyushu Univ., Fukuoka, Japan. Research Inst. for Applied Mechanics). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

Various accelerators have been used for the irradiation experiments of materials. The linear accelerator (LINAC) of Kyoto University Reactor Institute was used for the electron irradiation at low temperature, the Dynamitron accelerator in the Takasaki Laboratory, JAERI, was used for electron irradiation also, the tandem accelerator in Kyushu University for the simulation study of the cascade defects caused by 14 MeV neutrons, and the Van de Graaff accelerator for the study on the behavior of He in materials. Among various experiments, the diffuse X-ray scattering from electron-irradiated iron is described in this paper. The amount of irradiated electrons was 6 x $10^{18}/cm^2$. The isochronal annealing curve of lattice parameter change and the electrical resistivity of iron were measured. The relaxation volume of self-interstitial atoms and vacancies of FCC, BCC and HCP metals were obtained. From the diffuse X-ray scattering experiment, the formation of cluster was observed.

9397 (LA-UR—86-3811) **Microstructure of metastable metallic alloy films produced by laser breakdown chemical vapor deposition and ion implantation.** Menon, S.K.; Jervis, T.R.; Nastasi, M. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 8p. (CONF-861207—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002914.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Thin films produced by laser breakdown chemical vapor deposition from nickel and iron carbonyls and by implanting Ni foils with varying levels of C have been characterized by transmission electron microscopy. Decomposition of $Ni(CO)_4$ produces polycrystalline films of fcc Ni and metastable ordered hexagonal Ni_3C. This metastable phase is identical to that produced by gas carburization, rapid solidification of Ni-C melts, and ion implantation of C into Ni at low concentrations. Increasing the H_2 content in the gas mixture during laser deposition reduces the grain size of the films significantly with grain sizes smaller than 10 nanometers produced. Laser decomposition of $Fe(CO)_5$ produces films with islands of fcc gamma-Fe and finely dispersed metastable Fe_3C (Cementite). In addition, the ferrous oxides Fe_2O_3 and Fe_3O_4 were found in these samples. Implants of C into pure Ni foils at 77°K and at a concentration of 35 at. % produced amorphous layers. Implants at the same dose at room temperature did not produce amorphous layers.

9398 (LA-UR—86-3997) **Accurate interatomic potentials for Ni, Al and Ni/sub 3/Al.** Voter, A.F.; Chen, Shao Ping. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-861207—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002896.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

To obtain meaningful results from atomistic simulations of materials, the interatomic potentials must be capable of reproducing the thermodynamic properties of the system of interest. Pairwise potentials have known deficiencies that make them unsuitable for quantitative investigations of defective regions such as crack tips and free surfaces. Daw and Baskes [Phys. Rev. B 29, 6443 (1984)] have shown that including a local "volume" term for each atom gives the necessary many-body character without the severe computational dependence of explicit n-body potential terms. Using a similar approach, we have fit an interatomic potential to the Ni_3Al alloy system. This potential can treat diatomic Ni_2, diatomic Al_2, fcc Ni, fcc Al and $L1_2$ Ni_3Al on an equal footing. Details of the fitting procedure are presented, along with the calculation of some properties not included in the fit.

9399 (LA-UR—86-4041) **Atomistic simulations of surface relaxations in Ni, Al, and their ordered alloys.** Chen, S.P.; Voter, A.F.; Srolovitz, D.J. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-861207—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002893.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

We have performed a series of simulations to examine the atomistic nature of surface relaxations in pure metals and ordered alloys. The surface relaxations (Δd/sub n,n+1/) are shown to be oscillatory and to decay rapidly into the bulk. The period and form of the oscillation may be determined by simple geometrical arguments. The oscillation wavelength is always of order an atomic diameter. In pure metals, the surface layer of atoms always displaces inward. However, in the ordered alloys the larger atom may displace outward. On planes composed of more than one atom types, rippling occurs.

9400 (LA-UR—86-4066) **Atomistic simulations of [001] symmetric tilt boundaries in Ni_3Al.** Chen, S.P.; Voter, A.F.; Srolovitz, D.J. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-861207—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002889.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

We report a systematic atomistic simulation study of [001] symmetric tilt grain boundaries (GB) in Ni_3Al, Ni, and Al. We found that the grain boundary energies and cohesive energies of Ni_3Al and pure fcc Ni are approximately the same. Grain boundary energies and cohesive energies in Ni_3Al depends strongly on the grain boundary composition. The Al-rich boundaries have highest grain boundary energies and lowest cohesive energies. This offers an explanation for the stoichiometric effect on the boron ductilization.

9401 (LBL—21790) **Pressure dependences of the specific heats of UPt_3, UBe_{13}, and $CeAl_3$.** Phillips, N.E.; Fisher, R.A.; Flouquet, J.; Giorgi, A.L.; Olsen, J.A.; Stewart, G.R. (Lawrence Berkeley Lab., CA (USA); Centre National de la Recherche Scientifique, 38 - Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures; Los Alamos National Lab., NM (USA)). May 1986. Contract AC03-76SF00098. 15p. (CONF-860746—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002566.

From Anomalous rare earths and actinides; Grenoble, France (7 Jul 1986).

The specific heats of UPt_3, UBe_{13} and $CeAl_3$ have been measured under pressures to 9 kbar. The densities of electronic states decrease sharply with increasing pressure. For UPt_3 the spin fluctuation terms decrease with increasing pressure, suggesting a positive correlation with superconductivity. For $CeAl_3$ there is a qualitative change in the temperature dependence of the specific heat.

9402 (LBL—22331) **Metallic glasses and their descendants.** Gilman, J.J. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 12p. (CONF-8610172—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002546.

From International new materials conference and exhibition; Osaka, Japan (16 Oct 1986).

This has been a landmark year for metallic glasses as a new class of materials. More than 1000 large power-distribution transformers with glassy cores have been sold by the General Electric Company into the commercial marketplace. Also, the rate at which glasses have been produced has exceeded one million pounds per year (450,000 kg/y). Thus, in the 13 to 14 years that have passed since the first ductile, ferrous glass was invented, the growth in production-rate has averaged about 90% year. Since there is no reason to expect that this growth-rate will drop in the near future, metallic glasses have become an important new branch of metallurgy.

9403 **(MLM-MU—86-71-0004) Fracture toughness testing for the MC3478/79 retaining nut.** Merten, C.W. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 30 Nov 1986. Contract AC04-76DP00053. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003619.

A subsize, three-point bend specimen was developed for determining the fracture toughness of the maraging 350 steel used in the MC3478/79 retaining nuts. A comparison of test conditions and results with criteria for fracture toughness testing indicated that a valid value for K/sub Ic/ was obtained. Using the subsize test specimen, four heat-treating processes were evaluated. Scanning electron microscopy studies were performed in an attempt to correlate fracture surface appearance to fracture toughness. These studies suggested that as fracture toughness increases, the tendency toward quasi-cleavage decreases and dimple size increases.

9404 **(NAGRA-NTB—84-35) Creep behavior on carbon steels for final disposal containers: Literature review.** Rosselet, A. (Sulzer Bros. Ltd., Winterthur (Switzerland)). Sep 1984. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900277.

The NAGRA concept for final disposal of high-level waste foresees that the vitrified waste will be enclosed in corrosion-resistant containers before placement in the repository. According to the safety concept, the principal function of the containers is to prevent contact between the groundwater and the waste for a given time (1000 years), i.e., to delay the release of the content for this length of time. As a part of the mechanical properties evaluation program of the candidate materials for the containers, a review of the available literature on creep behavior of carbon steels has been undertaken. Due to the shortage of usable information, it is not possible to forecast exactly the amount of creep deformation in carbon steels over 1000 years at temperatures up to 140°C. However, the following conclusions can be drawn: At room temperature below the yield stress, no creep has been observed. An extrapolation of the available data to the design temperature of 140°C is not possible. The same is true of the data available for temperatures above 300°C. The reason is that the variation of the activation energy for creep (which characterizes the creep resistance of the material) with temperature is not known. The small amount of data for the temperature range 100 to 300°C can be used to estimate a creep deformation at 140°C for 1000 years of below 1%. It is also probable that the amount of deformation will depend more on the mechanical properties of the material (yield and ultimate strengths) than on the material itself (steel, cast steel, nodular iron). The possibility that the creep rate will be influenced by effects such as hydrogen diffusion or radiation cannot be excluded, as these points are scarcely documented. Consequently, an experimental determination of the creep behavior of the chosen material is recommended, if a creep strain of 1% or less cannot be tolerated.

9405 **(PNL—5766) User's guide for waste tank corrosion data model code.** Mackey, D.B.; Divine, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003700.

Corrosion tests were conducted on A-516 and A-537 carbon steel in simulated Double Shell Slurry, Future PUREX, and Hanford Facilities wastes. The corrosion rate data, gathered between 25 and 180°C, were statistically "modeled" for each waste; a fourth model was developed that utilized the combined data. The report briefly describes the modeling procedure and details on how to access information through a computerized data system. Copies of the report and operating information may be obtained from the author (DB Mackey) at 509-376-9844 of FTS 444-9844.

9406 **(PNL-SA—14069) MCC [Materials Characterization Center] corrosion tests at reference testing conditions for A27 cast steel in Hanford ground water.** Merz, M.D.; Gerber, F.; Wang, R. (Pacific Northwest Lab., Richland, WA (USA); Flow Industries, Inc., Kent, WA (USA)). Nov 1986. Contract AC06-76RL01830. 16p. (CONF-861207—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002872.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The corrosion of A27 cast steel in synthetic Hanford ground water was characterized by uniform wastage of the metal with no evidence of pitting or intergranular corrosion. The average corrosion rate decreased with increasing test duration which indicated that the corrosion rate for long time periods can be conservatively predicted for conditions simulated by these tests. The corrosion products for the static and flowby tests were very similar and consisted of a gel-like, very adherent, amorphous layer next to the metal with adherent packing material (basalt = bentonite) attached. The corrosion product for the air/steam tests was a very thin, asherent layer that was uniform over the specimen surfaces. No spalling was observed for periods as long as 120 days. The amount of corrosion for the air/steam tests at 300°C was very small with an average corrosion rate of 1.62 μm/y for 120-day tests. The corrosion rate decreased with time and there was no indication of localized corrosion. A comparison of interlaboratory results for the three kinds of corrosion tests indicated that a relative large component of variability occurred between laboratories compared to smaller variations within each laboratory. For the longest tests compared, the total individual specimen relative standard deviations, including within-laboratory variations and between-laboratory variations, were 12% for the 120-day pressure vessel tests, 15% for the 300-day flowby tests, and 26% for the 120-day air/steam tests.

9407 **(PNL-SA—14218) Evaluation of the susceptibility of ASTM A216 grade WCA mild steel to stress corrosion cracking in simulated salt repository environments.** Pitman, S.G. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1986. Contract AC06-76RL01830. 15p. (CONF-861207—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002871.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

In current conceptual designs, a mild steel (ASTM A216 Grade WCA) is the reference container material for use in high level nuclear waste packages intended for emplacement in a salt repository. The resistance of the steel to stress corrosion cracking (SCC) is being investigated as part of the effort underway to verify the suitability of the material for waste package applications. Static tests (U-bend and bolt-loaded fracture toughness specimens) and dynamic tests (slow strain rate and corrosion fatigue) were conducted on both as-cast and weldment specimens of the material, in both low-Mg and high-Mg halite-saturated brines, in the temperature range of 90 to 200°C. The investigations indicate that the steel is not susceptible to SCC under the test conditions employed.

9408 **(SAND—86-1359C) Surface alloys of icosahedral AlMnSi with phason distortions.** Follstaedt, D.M.; Knapp, J.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1986. Contract AC04-76DP00789. 7p. (CONF-861207—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003031.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The microstructures produced by electron-beam melting and by ion-beam mixing Al/Mn and Al/Mn/Si layers on Si substrates are examined. The treatments were found to incorporate Si from the substrate into the surface alloy. Several phases formed, depending on treatment, including α- and β-AlMnSi, μ-AlMn (epitaxial on Si(111), and amorphous and icosahedral AlMnSi. The observed microstructures relate the novel icosahedral phase to other phases and elucidate its formation kinetics. Diffraction patterns from large icosahedral grains (up to 5 μm) show distortions in the position and shape of weak (but not strong) reflections, as predicted for phason defects in a quasicrystalline lattice, one of the structures proposed for icosahedral phases.

9409 **(VTT-TUTK—402) Reliability of reactor materials. Fracture mechanics.** Toerroenen, K.; Aho-Mantila, I. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). May 1986. 148p. NTIS (US Sales Only), PC A07/MF A01. File Number DE87750403.

This report is the final technical report of the fracture mechanics part of the Reliability of Reactor Materials Programme, which was carried out at the Technical Research Centre of Finland

(VTT) through the years 1981 to 1983. Research and development work was carried out in five major areas, viz. statistical treatment and modelling of cleavage fracture, crack arrest, ductile fracture, instrumented impact testing as well as comparison of numerical and experimental elastic-plastic fracture mechanics. In the area of cleavage fracture the critical variables affecting the fracture of steels are considered in the frames of a statistical model, so called WST-model. Comparison of fracture toughness values predicted by the model and corresponding experimental values shows excellent agreement for a variety of microstructures. Different possibilities for using the model are discussed. The development work in the area of crack arrest testing was concentrated in the crack starter properties, test arrangement and computer control. A computerized elastic-plastic fracture testing method with a variety of test specimen geometries in a large temperature range was developed for a routine stage. Ductile fracture characteristics of reactor pressure vessel steel A533B and comparable weld material are given. The features of a new, patented instrumented impact tester are described. Experimental and theoretical comparisons between the new and conventional testers indicated clearly the improvements achieved with the new tester. A comparison of numerical and experimental elastic-plastic fracture mechanics capabilities at VTT was carried out. The comparison consisted of two-dimensional linear elastic as well as elastic-plastic finite element analysis of four specimen geometries and equivalent experimental tests.

9410 **(YJT—86-09) Hydrogen embrittlement of titanium and its alloys - a literature review.** Aho-Mantila, I.; Haemaelaeinen, H. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). May 1986. 82p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750405.

Hydrogen embrittlement data of titanium and its alloys is reviewed. Especially the results obtained in spent nuclear fuel repository conditions with commercially pure titanium and TiCode-12 alloy are examined. The results show that the mechanical properties of titanium are not much affected by hydrogen when tested by smooth specimens. Much greater effects can be expected with notched fracture mechanics specimens. However, only limeted data is available. Hydrogen distribution in titanium is affected by stress, alloy composition and temperature gradients. In order to model the hydrogen-induced crack growth in titanium much more mechanistic work is needed especially to understand the behaviour of hydrogen in crack tip stress field. 69 refs.

9411 **(ZfK—575) Adsorption of metals on metal surfaces and the possibilities of its application in nuclear chemistry. Model calculations on the separation of radionuclides via thermic desorption from solid metal surfaces.** Roesch, F.; Eichler, B. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jan 1986. 65p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700262.

Starting with values of differential enthalpies of adsorption ΔH-bar/sub a/ the desorption temperatures of 65 adsorptive metals as to 40 adsorbent metals have been obtained according to a model calculation. With regard to their potential separation by means of selective desorption from solid metal surfaces the desorption behaviour of combinations of radionuclides Me_1 (proton number Z)/Me_2 (proton number $Z + 1$) and Me_1 (proton number Z)/Me_2 (proton number $Z + 2$) was calculated. Basing on the parameters of the model assumptions, the results of the calculations allow estimations about the desorption temperatures of the adsorptive Me_1 as well as the temperature differences to the desorption of the adsorptive Me_2 and about the efficiency of the potential separation process.

9412 **Density functional description of molecular bonding within the local spin density approximation.** Painter, G.S. (Oak Ridge National Lab., TN). *Journal of Physical Chemistry;* **90**: No. 22, 5530-5535(23 Oct 1986). Contract AC05-84OR21400.

The description of the ground-state properties of solids has been greatly advanced through the density functional theory applied in the local spin density approximation (LSDA). The range of validity of the LSDA has been found to encompass even the small molecule regime. Representative results are reviewed for the first-row dimers, with particular focus on a detailed comparison of molecular bonding of the Be_2 molecule as described in many-electron and LSDA theories. The success of the LSDA in applications to inhomogeneous systems is discussed in terms of the known properties of the exchange-correlation hole. Bonding the in the transition-metal dimer, Cr_2, as described in the LSDA is discussed and related to other studies.

9413 **Cation vacancy concentrations in ferrous sulfide containing chromium and manganese.** Pawel, R.E.; Campbell, J.J. (Oak Ridge National Lab., Oak Ridge, TN). *Oxidation of Metals;* **26**: No. 3/4, 253-262(Oct 1986).

A gravimetric technique was used to measure the cation vacancy concentration in pure ferrous sulfide and in ferrous sulfide containing small amounts of chromium or manganese. Measurements were made over a wide range of sulfur pressures, defined by H_2/H_2S mixtures, at 500,600, and 700 ° C (723, 823, and 923 K). Chromium was found to increase the defect concentration by an amount consistent with the Wagner-Hauffe model pertaining to aliovalent cations. Also in accord with this model, manganese did not measurably affect the cation vacancy concentration.

9414 **Phase slip centers in long superconducting aluminum microbridges.** Liengme, O.; Baratoff, A.; Martinoli, P. (Argonne Natl. Lab., Argonne, IL). *Journal of Low Temperature Physics;* **65**: No. 1/2, 113-132(Oct 1986).

Phase slip center (PSC) measurements in long superconducting aluminum microbridges are reported. The usual divergence of the effective size 2A of a PSC, as indicated by its differential resistance, occurs only at temperatures A is observed to be essentially constant; this is attributed to the onset of intermediate regions separating the core from the usual diverging regions of exponential electric field penetration (wings). In the low-temperature regime the equivalent decay time A^2/D is found to be much larger (50 nsec) than the inelastic scattering time obtained from homogeneous charge imbalance experiments (12 nsec). In contrast, an analysis of the divergence gives the same order of magnitude (7 nsec). Furthermore, the onset of the intermediate regions is correlated with departure from local equilibrium close to the core. The effect of pair breaking on the local equilibrium condition is also discussed and compared with results from different experiments. Special emphasis is given to the interpretation of data from inhomogeneous samples where a spatially localized pair-breaking contribution is expected. Detailed analysis of the inhomogeneity itself provides complementary information as well as additional physical insight.

9415 **Comments on an overview of the bainite reaction.** Aaronson, H.I.; Rigsbee, J.M.; Trivedi, R.K. (Dept. of Metallurgical Engineering and Materials Science, Carnegie-Mellon Univ., Pittsburgh, PA 15213). *Scripta Metallurgica;* **20**: No. 9, 1299-1304(Sep 1986).

In a recent review of the bainite reaction in steel, other authors recounted structural and kinetic features of the proeutectoid ferrite, bainite and lath martensite transformations which suggest that all of them are a part of a single, unified sequence evolving with increasing driving force. At the end of the paper they invited "constructive debate" about their conclusions. Introduction of this response to their invitation may be usefully accomplished by noting immediately our basic points of agreement and of disagreement. With respect to the former, the authors agree with Purdy and Hillert, as well as with a number of other colleagues that proeutectoid ferrite, upper bainite and lower bainite are part of a continuum of microstructural development with important commonalities. They also agree that none of these reactions can occur more rapidly than volume diffusion-control allows. However, there is a significant substructure of differences with respect to the details underlying both of these areas of agreement. And they do not accept any fundamental continuity between lower bainite and martensite. At the end of the discussion, another viewpoint on these matters is presented.

9416 **Icosahedral crystals from cuts in six-dimensional space.** Bak, P. (Dept. of Physics, Brookhaven National Lab., Upton, NY 11973). *Scripta Metallurgica;* **20**: No. 9, 1199-1204(Sep 1986).

In condensed matter physics it is traditionally assumed that crystalline ordering must necessarily be associated with a regular periodic lattice. A crystal structure is formed by placing a basis of atoms at each lattice point. The symmetry of the crystal is described by the space group which is the mathematical group containing all the symmetry operations which leave the crystal invariant. In addition to the discrete translations which reflect the periodicity of the crystal, the space group includes rotation and reflection symmetries forming the so-called point group. One of the consequences of the existence of an infinite periodic lattice is that the point group cannot contain five-fold symmetry operations. When the stability of crystal ordering is investigated by some physical model, the analysis is always restricted to comparing energies of two or more regular crystal structure belonging to the 230 3D space groups. Yet it has never been proven that the only stable way of having long-range positional ordering of atoms is on a periodic lattice. Indeed, in condensed matter physics it is well known that there exist incommensurate crystals, which can be formed by superposition of structures with incommensurable periods. However, for these crystals one can always define a basic lattice belonging to one of the usual space groups, and the positions of atoms are modulated around these lattice positions. If the crystal ordering does not take place on a lattice, there is no reason to rule out ab initio the possibility of having a five-fold axis. In fact, from a purely mathematical point of view, it has been known for some time that it is possible to arrange a small number of different "titles" in an infinite ordered arrangement which has five-fold symmetry.

9417 Site occupation determinations by APFIM for Hf, Fe, and Co in Ni/sub 3/Al. Miller, M.K.; Horton, J.A. (Metal and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN 37831). *Scripta Metallurgica;* **20**: No. 8, 1125-1130(Aug 1986). Contract AC05-84OR21400.

The addition of boron to Ni/sub 3/Al has produced a fabricable material with good high temperature properties. Some substitutional elements have also been added to the base material to further refine its properties for particular applications. One aspect in understanding the influence of these additions is to determine the distribution of the substitutional elements between the nickel and aluminum sites of the ordered Ll/sub 2/ lattice. The atomic spatial resolution of the atom probe field-ion microscope (APFIM) permits the site occupation probability of substitutional elements and the local degree of order to be measured directly. These parameters are determined by measuring the composition of successive planes in the ordered lattice. The site occupation probability is calculated from the preference of the substitutional elements between the different atomic layers in the ordered structure. One advantage of this technique is that it can be applied to normal polycrystalline materials and does not require the specimen to be a single crystal. This technique can only be used to determine the site occupation probability for elements that substitute in the ordered lattice. Three substitutional elements, hafnium, iron, and cobalt, were selected for this study because of their anticipated different site preference.

9418 Magnetic field patterns in josephson junctions. Yang, H.C.; Finnemore, D.K. (Ames Lab, Iowa State Univ, Ames, IA). *Journal of Low Temperature Physics;* **64**: No. 3/4, 187-194(Aug 1986).

The critical currents of Pb/Ag/Pb Josephson junctions have been measured as a function of magnetic field and temperature in order to study the types of magnetic field distributions that occur in superconductor-normal metal-superconductor (SNS) junctions. A study is made of the quantum interference regime near the critical temperature where the junction is filled with vortices and the crossover to Meissner-like behavior at low temperature occurs. Special emphasis is placed on the changes in effective area of the junction as the London and Josephson penetration depths change with temperature. A mapping of the crossover regime in the temperature-magnetic field plane is given.

9419 Electron beam welding of heavy-section 3Cr-1.5 Mo alloy. King, J.F.; David, S.A.; Sims, J.E.; Nasreldin, A.M. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN). *Welding Journal (Miami);* **65**: No. 7, 39-47(Jul 1986). Contract AC05-84OR21400.

Welding of thick-section steels is a common practice in the fabrication of energy systems. Components such as pressure vessels are large and must be economically fabricated with high integrity. The fabrication cost is strongly influenced by the speed at which these large components can be welded. Conventional welding processes, such as shielded metal arc (SMAW) and submerged arc (SAW), are time-consuming and expensive. Hence, there is a great need to reduce welding time and the tonnage of weld metal deposited. Electron beam welding (EBW) is a process that could be used to achieve dramatic reduction in the welding time and, hence, the cost. It has several attractive characteristics for the welding of thick sections.

9420 Fast diffusion and electrotransport of iron in scandium. Axtell, S.C.; Okafor, I.C.I.; Conzemius, R.J.; Carlson, O.N. (Ames Lab., IA, USA; Iowa State Univ. of Science and Technology, Ames, USA. Dept. of Materials Science and Engineering). *Journal of the Less-Common Metals;* **115**: No. 2, 269-279(15 Jan 1986).

The diffusion and electrotransport properties of iron in α and β scandium were measured over the temperature range 970 to 1515°C. The diffusion coefficients are of the order of 10^{-9} to 10^{-10} $m^2 s^{-1}$ in both phases. The effective valence Zsup(*) is negative at all temperatures corresponding to solute migration in the direction of electron flow. The activation energy for diffusion of iron in α-Sc is 54 +- 6 kJ mol^{-1} and the diffusion constant is 1.5 x 10^{-7} $m^2 s^{-1}$. The solubility of iron in the α phase was determined to be between 0.01 and 0.025 at.% at 700°C increasing to less than 0.043 at.% at 825°C. The magnitude of the diffusivity of iron in scandium was found to be similar to that of iron in other rare earth metals.

9421 Dynamic consolidation of metal powders. Gourdin, W.H. (Lawrence Livermore National Lab., CA). *Progress in Materials Science;* **30**: No. 1, 39-80(1986). Contract W-7405-ENG-48.

A review and assessment of the dynamic consolidation of metal powders is presented. Primary emphasis is placed on demonstrating the relationship between the shock-wave physics during consolidation and the initial and final metallurgical states of the compact. Some of the technological aspects of the process are also discussed. 85 references, 33 figures, 5 tables.

9422 Role of FBC deposits in the corrosion of heat exchanger materials. Natesan, K. (Materials Science and Technology Div., Argonne National Lab., 9700 South Cass Avenue, Argonne, IL 60439). pp 18 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—). Contract W-31-109-ENG-38.

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Metallic materials selected for the construction of in-bed heat exchangers and tube support structures in fluidized-bed combustion (FBC) systems must withstand the corrosive conditions prevalent in these systems. Oxidation/sulfidation interactions leading to accelerated metal wastage of in-bed materials can occur owing to the presence of sorbent deposits on the metal surfaces and/or the low oxygen partial pressures in the exposure environment. The paper discusses the mechanisms of sulfidation of iron-base ferritic and austenitic alloys and the roles of sorbent chemistry, gas chemistry, metal temperature, and gas cycling conditions. Data on scale thickness and depth of intergranular penetration are presented for carbon steel, Fe-2 1/4Cr-1Mo and Fe-9Cr-1Mo ferritic steels, Types 304 and 310 stainless steel and Incoloy 800 as a function of deposit chemistry.

9423 Effect of hard second-phase particles on the erosion resistance of model alloys. Kosel, T.H.; Aptekar, S.S. (Dept. of Metallurgical Engineering and Materials Science, Univ. of Notre Dame, Notre Dame, IN 46556). pp 15 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

The dependence of erosion rate on second phase volume fraction (SPVF) has been studied for Cu/Al/sub 2/O/sub 3/ and Cu/WC(W/sub 2/C) model alloys produced by pressing and sintering. The intention was to investigate the reasons for the poor contribution to erosion resistance made by large hard second phase particles (SPP) in other studies. The results show that for Cu/Al/sub 2/O/sub 3/ alloys, the erosion rate generally increased with SPVF, demonstrating a negative contribution to erosion resistance. This occurred despite the fact that the measured erosion rate of monolithic Al/sub 2/O/sub 3/ was lower by one to two orders of magnitude than that of the pure matrix. Changing from severe erosion with large erodent particles at high velocity to mild conditions with small erodent at low velocity caused a change from depression of the SPPs to protrusion from the surface, with some improvement of the relative erosion resistance compared to the pure matrix. For Cu/WC(W/sub 2/C) alloys, changing from severe to mild erosion conditions caused a change from an increase of erosion with SPVF to a decrease. The results are discussed in terms of the increased microfracture of the unsupported edges of the second phase particles compared to a flat single-phase surface. This edge is consistent with the results, and explains observations not predicted by existing theories for erosion of single-phase materials. A model is introduced which predicts a new averaging law for the erosion rate of a two-phase alloy in terms of erosion rates of its constituent phases.

9424 **Femtosecond time-resolved transmissivity of laser heated thin copper films.** Elsayed-Ali, H.; Norris, T.; Pessot, M.; Mourou, G. (Univ. Rochester, Lab. for Laser Energetics, Rochester, NY 14623-1299). pp 150-151 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The phenomenon of inequality between electron and lattice temperatures in metals subjected to ultrafast heating (laser pulse width ≦ electron-phonon energy relaxation time) was postulated some time ago. However, very few experimental observations of such inequality have been accomplished. In a previous experimental observation of picosecond ($\approx$5-ps FWHM) time-resolved reflectivity or copper during laser heating of up to a few degrees, a fast transient was observed. This observation was interpreted to be due to rapid electronic heating which subsequently thermalizes with the lattice. In another thermally enhanced multiphoton photoemission in tungsten heated by amplified 75-fs laser pulses has provided evidence of nonequilibrium heating. The authors report results on thermomodulation transmissivity of thin copper films heated by amplified 150-fs laser pulses, which were sufficient to time resolve the initial fast transient.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 8903, 9222, 9229, 9229, 9338, 9338, 9339, 9339, 9413, 9553, 9554, 9604, 9620, 9652, 9653, 9677, 10417

9425 **(BMI—2119) Failure of ceramics from multiaxial stresses: Final report.** Rosenfield, A.R.; Duckworth, W.H.; Shetty, D.K. (Battelle Columbus Labs., OH (USA)). 21 Nov 1984. Contract AT02-81CH92127. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002780.

Specimens containing indenter flaws were studied. Biaxial flexure showed higher fracture stresses than uniaxial flexure. Tension-compression tests using diametral compression did not show a stress state effect. A post processor code was developed to calculate the J integral. Effects of Young modulus and density on crack branching were studied. Statistical analysis of strength data was carried out. (DLC)

9426 **(CEA-R—5344) Electronic transport in boron carbides: temperature (4K-300K), frequency (0-1 GHz) and composition ($B_{13}C_2$-B_4C) effects.** Kormann, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1986. 124p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750719.

Boron carbide is a light ceramics of industrial interest. The equilibrium diagram reveals a large compositional range (B_9C to B_4C). The compositions close to the boundary B_4C are obtained by pressing directly in graphite dies while the other compositions were obtained by using boron nitride lined graphite dies and boron additions to the commercial powders. The starting point of the present study was the idea to use the electrical transport properties as possible ways of characterising the industrial materials. We were thus led to measure at low temperatures dc and ac conductivity, dielectric constant and thermopower. The successful study of a measurement method for ac measurements between 10 KHz and 1 GHz and between 4 K and 300 K was one of the main experimental points of the present work. Ac measurements have permitted a clear separation between bulk and grain boundary effects on the transport. The bulk results were analysed in terms of the usual conduction models in disordered solids (hopping, polarons...).

9427 **(CONF-8609138—4) Opportunities and problems in wavelength tunable lasers based on vacancy defects in refractory oxides.** Chen, Y.; Orera, V.M.; Gonzalez, R.; Ballesteros, C. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002406.

From 5. europhysical topical conference on lattice defects in ionic materials; Madrid, Spain (8 Sep 1986).

The primary methods for producing vacancies in the refractory oxides for tunable lasers are neutron irradiation and thermochemical reduction at high temperatures. The latter offers several distinct advantages. However, there are two serious problems: long-lived phosphorescence from anion vacancies and crystal darkening. The former is shown to be due to H^- ions which serve as metastable electron traps to form H^{2-} ions (proton with three electrons occupying oxygen vacancy sites). The localized vibrational modes and electronic transitions of the H^{2-} ions have been identified. Photoconversion between F and F^+ centers is shown to involve $H^- \rightleftharpoons H^{2-}$ conversion. The crystal darkening is shown by analytical electron microscopy techniques to be due to scattering from metallic precipitates containing primarily iron.

9428 **(DOE/CE—0173) The DOE Industrial Energy Conservation Program: Overview of ceramic research.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Industrial Programs). Dec 1986. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003613.

In general, ceramics projects accounted for over 10% of the $41 million in DOE-IP allocated funding, and involved almost 13% of the 94 FY 1986 funded projects. The bulk of these efforts was found to include three discrete, coordinated subprograms whose main objective was to promote the use of ceramics technology in specific industrial applications: advanced heat exchangers; inert electrodes; and membranes.

9429 **(DOE/ER/12076—T2) The migration of grain boundaries in ceramic materials with particular reference to the sintering process: Final report for the period July 15, 1982-May 14, 1984.** Carter, C.B. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). 31 Aug 1985. Contract AC02-82ER12076. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003372.

The progress made during the first two years of a program to study the migration of grain boundaries in ceramic oxides is reported. The principal results of the program are concerned with the structure of grain boundaries in α-Al_2O_3, although important new information has also been obtrained on grain boundaries in spinels and both germanium and silicon. Attention is focussed on the basal twin boundary in α-Al_2O_3 which had been identified as a model interface in early work. A series of new grain boundaries exemplified by the (1123) twin are also discussed briefly as is the rhombohedral twin interface. Earlier results on the first-order ($\Sigma = 3$) twin in spinel have been extended with the development of models for the computer-simulation of high-resolution TEM images of these interfaces. A study of low-angle grain boundaries in spinel is giving new insight into the effect which the large size of the unit cell and the multiplicity of cations can have on structure of interfaces in ceramic materials in general. Finally the direction of the program in examining grain boundaries in covalent materials (Ge and Si) is discussed.

9430 (INIS-mf—10512, pp 44) **Reactive and non-reactive high rate sputter deposition of tungsten carbide.** Fuchs, K.; Roedhammer, P.; Bertel, E.; Gornik, E.; Netzer, F.P. (Metallwerk Plansee A.G., Reutte/Tyrol, Austria; Innsbruck Univ., Austria). 1986. NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9431 (INIS-mf—10512, pp 42) **Temporal evolution of lattice constant and rocking curve width in tantalum tritide.** Laesser, R.; Bickmann, K.; Trinkaus, H.; Wenzl, H. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9432 (INIS-mf—10512, pp 60) **Structure, electric conductivity, magnetic susceptibility and optical reflectivity.** Gruber, H.; Krautz, E.; Fritzer, H.P.; Gatterer, K. (Technische Univ., Graz, Austria. Inst. fuer Festkoerperphysik; Technische Univ., Graz, Austria. Inst. fuer Physikalische und Theoretische Chemie). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9433 (INIS-SU—354, pp 52-55) **High-frequency conductivity of vanadium dioxide monocrystals.** Andronenko, R.R.; Volkov, A.A.; Gorshunov, B.P. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike.; (No. 11).

In Plasma physics. Collection.

The results of measurements of spectra of dynamic conductivity of vanadium dioxide (VO_2) in a semiconductor phase on 200-1000 GHz frequencies in the 90-340 K temperature range are reported. 8 refs.; 2 figs.

9434 (INIS-SU—362, pp 6-9) **On effect of the barium-sodium niobate crystal composition on isofrequency dependences of light scattering intensity in the vicinity of ferroelectric phase transformation point.** Ivanova, S.V.; Naumova, I.I.; Gorelik, V.S. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780037.

Kratkie Soobshcheniya po Fizike.; (No. 9).

In Experimental and theoretical physics. Collection.

The paper is aimed at determining effect of the barium-sodium niobate (BSN) crystal composition on isofrequency dependences to correlate them with Curie temperature and other characteristics of ferroelectric phase transformation in this crystal. It is stated that change of BSN crystal composition results in the temperature shift of light scatttering intensity spectral anomalies correleating with the Curie point shift in this crystal. 2 refs.; 2 figs.; 1 tab.

9435 (INIS-SU—362, pp 10-13) **Superconducting current-induced phase transformation in NbN granulated films.** Motulevich, G.P.; Tikhanskij, M.V.; Antonova, E.A.; Konnik, O.V.; Sukhov, V.A. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780037.

Kratkie Soobshcheniya po Fizike.; (No. 9).

In Experimental and theoretical physics. Collection.

A series of peculiarities relating to superconducting current-induced transformation is noted as a result of measurements of voltampere characteristics of NbN granulated superconducting films. Interpretation of the results obtained is given. 6 refs.; 2 figs.

9436 (INIS-SU—373) **Influence of interactions between the magnetic centers on the rate of their longitudinal relaxation.** Peskovatskij, S.A. (AN Ukrainskoj SSR, Kharkov. Inst. Radiofiziki i Ehlektroniki). 1984. 37p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700187.

A systematic analysis of the influence of the magnetic centers, strongly coupled with a lattice, on the spin-lattice relaxation (SLR) of the other centers, weakly coupled with a lattice, is carried out. It is shown that the different mechanisms provide the different dependences of relaxation probabilities upon the temperature and concentration. The type of such dependences has been determined for a number of mechanisms. A comparative analysis of the theory and the experiment has been performed and the explanation of some experimental results previously considered to be anomal has been given. It is pointed out that there is a possibility to judge about the nature of magnetic center interactions considering their characteristics of the SLR. 22 refs.; 11 figs.

9437 (Juel-Spez—316, pp 41-46) **Ternary hydrides of platinum.** Bronger, W. (Technische Hochschule Aachen, Germany, F.R. Lehrstuhl und Inst. fuer Anorganische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

In the present work the atomic ordering and the structure of LiPtDsub(0.66) and $NaPtD_4$ are investigated by X-ray and neutron diffraction. New information is obtained on interatomic distances and the lattice sites of the potassium and platinum atoms. (BHO).

9438 (Juel-Spez—316, pp 199-205) **Experiments with polarized nuclei at very low temperatures.** Steiner, M. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H., Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

Concerning experiments with polarized nuclei at very low temperatures, at the Hahn-Meitner-Institut, Berlin, two different sorts of experiments were performed: 1) Investigations of the hyperfine field induced antiferromagnetic nuclear polarization, Isub(nuc), with unpolarized neutrons in CoF_2 and $DyPO_4$. 2) Investigations of hyperfine field enhanced nuclear polarization and adiabatic demagnetization in $HoVO_4$ with polarized neutrons. (BHO).

9439 (KURRI-TR—247, pp 14-19) **Irradiation effect of lithium oxide.** Noda, Kenji; Watanabe, Hitoshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1984. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780041. (CONF-8212114—).

From Study meeting on radiation effect of insulation materials; Kumatori, Osaka, Japan (13 Dec 1982).

Lithium oxide is the primary candidate material for the solid blanket of nuclear fusion reactors. The role of the blanket of nuclear fusion reactors is to produce tritium by the reaction of neutrons with lithium, to extract fusion energy as heat by moderating and thermalizing neutrons, and to shield superconducting magnets and others. Therefore, lithium oxide is exposed to neutrons, tritons and helium ions, and gamma ray, and suffers remarkable irradiation damage. This irradiation damage causes swelling and powdering, the promotion of tritium diffusion and the trapping of tritium, and exerts influence on tritium emission and the compatibility with structural materials. The research on the irradiation damage of lithium oxide is very important for the development of nuclear fusion reactors. In this research, in order to obtain the basic knowledge on the irradiation damage of lithium oxide, the irradiation damage in the lithium oxide irradiated with a reactor and a heavy ion accelerator was observed by electron spin resonance method and light absorption method. The experiment using the sintered piece and single crystal of lithium oxide and the results are reported.

9440 (KURRI-TR—247, pp 28-36) **Reactor irradiation effect of MgO single crystals.** Okada, Moritami; Nakagawa, Masuo; Moriyama, Takeyoshi. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.). 1984. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780041. (CONF-8212114—).

From Study meeting on radiation effect of insulation materials; Kumatori, Osaka, Japan (13 Dec 1982).

Among the absorption bands generated in MgO by neutron irradiation, those having the center at 250, 352, 570 and 975 nm are conspicuous, and their photo-sensitivity is strong. The 250 nm band with maximum absorption intensity is composed of two F-type centers having their centers at 245 nm (F-band) and 253 nm (F^+ band). It was suggested that 352 and 975 nm bands were due to the different transition in the same F_2 center. The 570 nm band was related to the defect formed in the displacement spike generated by high energy neutrons. Also this band was regarded as a compound absorption band. Recently, the authors have found that the intensity of the 570 nm band introduced in MgO was affected by the kinds and quantity of impurities, and was in complementary relation with the intensity of F_2 band. They found also the evidence that this absorption band was considered to be the compound band composed of two or more absorption bands. In this study, it was attempted to separate the components of this compound 570 nm absorption band by computer analysis, and discuss the properties of the defect centers which cause respective absorption bands from the effect of impurities and photo-sensitivity.

9441 (LA-UR—86-4047) **Characteristics of fluid flow in the combustion synthesis of TiC from the elements.** Valone, S.M.; Behrens, R.G. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 9p. (CONF-861207—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002892.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Finite reservoir effects on capillary spreading at small reservoir dimensions are explored numerically and related to wave propagation in combustion synthesis of TiC from elemental Ti and C. In addition a convective instability which may be activated by gravitational, surface tension or contact forces may cause void regions to coalesce thereby altering the void distribution in combustion synthesis products.

9442 (NAGRA-NTB—85-51) **Determination of crack growth parameters of alumina in 4-point bending tests.** Fett, T.; Keller, K.; Munz, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung 4; Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Keramik im Maschinenbau; Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Zuverlaessigkeit und Schadenskunde im Maschinenbau). Sep 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900257.

Alumina containers are being considered for the disposal of nuclear waste in a number of countries. For this ceramic material subcritical crack growth is an potentially important failure mechanism. The crack growth behavior of one particular type of hot isostatically pressed alumina has been investigated at 70°C in a strongly corrosive brine using fracture-mechanical methods. The use of a recently developed method for interpreting lifetime measurements in static bending tests allowed a determination of crack growth rates as low as 10^{-11} m/s. It was observed that the dependence of the crack growth rate on the stress intensity factor can be described in terms of a power low over the whole range investigated. The exponent in the power law was found to be close to $n = 20$. Published values for the same material, determined by the double torsion method, lie above $n = 100$. The discrepancy between these values is probably due to R-curve effects (i.e. to an increase of the critical stress intensity factor in the course of crack extension) that influence the behavior of macroscopic cracks and that of natural cracks about 100μm in size differently. Because of the high lifetime required of containers for final disposal of radioactive waste the low values determined for the crack growth exponent imply that tensile stresses must be kept quite small.

9443 **New materials synthesis: characterization of some metal-doped antimony oxides.** Teller, R.G.; Antonio, M.R.; Brazdil, J.F.; Grasselli, R.K. (Standard Oil Research Center, Cleveland, OH). *Journal of Solid State Chemistry;* **64**: No. 3, 249-260(Oct 1986).

In order to understand the chemistry of altermetal dopants in antimony oxide, the detailed structural characterization of two β-Sb_2O_4 compounds is reported, Mo-doped β-Sb_2O_4 (1.5 metal%) and V-doped β-Sb_2O_4 (5 metal%). The methods used to characterize these materials are X-ray and neutron diffraction, scanning electron microscopy, Mo K-edge extended X-ray absorption fine structure spectroscopy, and elemental analysis. The atomic position of each of these dopants in Sb_2O_4 is radically different as is the overall effect on the host structure. Molybdenum does not substitute for Sb atoms, rather the Mo atoms are found in channels of electron density formed by Sb^{3+} lone pairs. The two nearest Sb^{3+} are absent and the oxygen stoichiometry is preserved. The formula is Sb/sub 1.97/ Mo/sub 0.015/O_4. Vanadium incorporates substitutionally for the Sb^{3+} atoms and there are random oxygen vacancies in the resultant structure. The formula is Sb/sub 1.9/V/sub 0.1/O/sub 3.67/. In each case the atomic positions of the host structure (Sb and O) are remarkably unaltered. The β-Sb_2O_4 structure can accommodate Mo and V simultaneously, presumably both means of metal incorporation are employed in this ternary oxide.

9444 **Metal-metal-bonded scandium cluster ($Sc_7Cl_{12}Z$) and infinite chain (Sc_4Cl_6Z) phases stabilized by interstitial boron or nitrogen (Z).** Hwu, S.J.; Corbett, J.D. (Iowa State Univ., Ames). *Journal of Solid State Chemistry;* **64**: No. 3, 331-346(Oct 1986). Contract W-7405-ENG-82.

The title phases have been obtained in high yields from reactions of metal, trichloride, and elemental boron or nitrogen in sealed niobium tubing at 850-950°C. Single crystal structural studies on samples of all four phases obtained by autogenous vapor phase transport reactions are reported. The $Sc_7Cl_{12}Z$ compounds contained discrete $Sc_6Cl_{12}Z$ clusters together with isolated scandium(III) atoms while Sc_4 $Cl_{12}Z$ consists of infinite chains of the condensed clusters sharing trans Sc-Sc edges, comparable to those found in Sc_5Cl_8Z and, especially, the closely related $NaMo_4O_6$. The scandium-scandium bond lengths in these reflect both the electron count and the effective interstitial size. Extended-Hueckel molecular orbital calculations for both borides demonstrate the prime importance of strong Sc-Z bonding. The chain phases are predicted to be metallic.

9445 **Synthesis and structure of ternary molybdenum oxides MMo_8O_{10} (M = Li or Zn) having orthogonal nonintersecting octahedral cluster chains.** Lii, K.H.; McCarley, R.E.; Kim, S.; Jacobson, R.A. (Ames Lab., IA). *Journal of Solid State Chemistry;* **64**: No. 3, 347-358(Oct 1986). Contract W-7405-ENG-82.

The new compounds $Limo_8O_{10}$ (I) and $ZnMo_8O_{10}$ (II) have been prepared via reactions in sealed Mo-tubes at 1370-1450°C between Li_2MoO_4, MoO_3, and Mo(3 : 16 : 29 mole ratio), and ZnO, MoO_3, and Mo (1 : 3 : 5 mole ratio), respectively. The isomorphous compounds are tetragonal, space group $I4_1md$, $Z = 4$, with lattice constants $A = 5.8515(6)$ A, $c = 24.783(3)$ A for I, and $a = 5.8961(4)$ A, $c = 24.840(3)$ A for II, as determined from Guinier X-ray powder patterns. Single crystal structure determination shows that these compounds are constructed from infinite chains consisting of edge-shared octahedral cluster units. The structure can be viewed as a stacking along the c axis of layers consisting of parallel chains, with the chains in successive layers oriented alternately along the a and b axes. It is shown that the structures are related to the spinel and rock salt structures through an ordered-defect arrangement of the Mo and O atoms.

9446 **U/sub 3/O/sub 8/ powder from uranyl-loaded cation exchange resin.** Mosley, W.C. (E.I. du Pont de Nemours & Co., Inc., Savannah River Lab., Aiken, SC 29808). *American Ceramic Society Bulletin;* **65**: No. 8, 1187-1190(Aug 1986). Contract AC09-76SR00001.

Production-size batches of U/sub 3/O/sub 8/, suitable for powder metallurgy fabrication of Al-U/sub 3/O/sub 8/ cores for reactor fuel tubes, have been produced by deep-bed calcination of granular uranyl-loaded macroporous sulfonate cation exchange resin at 900° to 950°C in air. Deep-bed calcination is the backup process for the reference process of rotary calcination and sintering. These processes are to be used for recycling uranium to produce U/sub 3/O/sub 8/ in the fuel production facility to be built at the Savannah River Plant.

9447 **CO disintegration of stainless steel fiber-reinforced refractory castables.** Martin, C.; Brown, J.J. Jr. (Dept. of Materials Engineering, Virginia Polytechnic Institute, Blacksburg, VA 24061). *American Ceramic Society Bulletin;* **65**: No. 9, 1047-1051(Jul 1986).

The effects of stainless steel fiber additions on the resistance of refractory castables to CO and steam were investigated. A series of high and intermediate alumina calcium aluminate-bonded castables was prepared containing several commercial stainless steel fibers. Compressive strength and abrasion resistance of the castables following exposure to high pressure carbon monoxide and steam at 500°C were comparable to those of samples without stainless steel fibers. The addition of stainless steel fibers to refractory castables did not change the CO resistance of the castables unless they were fired in air before CO exposure. Airfiring creates oxide layer so the fibers which ultimately causes castable disintegration.

9448 **Review of self-irradiation effects in Pu-substituted zirconolite.** Clinard, F.W. Jr. (Los Alamos National Lab., Los Alamos, NM 87545). *American Ceramic Society Bulletin;* **65**: No. 8, 1181-1186(Aug 1985).

Self-irradiation effects due to alpha decay in Pu-substituted zirconolite (CaPuTi/sub 2/O/sub 7/) have been assessed by dilatometry, TEM, microindentation testing, and differential thermal analysis. The crystalline material became metamict as a result of accumulation of alpha recoil tracks, with accompanying swelling, reduction of hardness, and increase in fracture toughness. Storage at elevated temperature partially or wholly suppressed metamictization. Studies of recovery from the metamict state showed that ease of crystallization depends on extend of prior damage and that heavy damage reduces the amount of stored energy. These results are interpreted in terms of competition between damage accumulation and annealing, variations within the metamict state, and the role of a heterogeneous microstructure.

3606 Other Materials

REFER ALSO TO CITATION(S) 8898, 8898, 9045, 9069, 9286, 9317, 9363, 9429, 9525, 9543, 9568, 9614, 9614, 9614, 9615, 9615, 9647, 9650, 9668, 9817, 9936, 10106, 10110, 10148, 10420

9449 **(AD-A—172422/8/XAB) High- and low-energy particle-beam interactions with solids. Final report.** Winograd. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1986. 8p. NTIS, PC A02/MF A01.

The major goal of this research has been to establish a center for the preparation and surface characterization of advanced materials related to the construction of high-speed electronic devices. The focal point of the experimental side of the center was a molecular-beam epitaxial (MBE) growth facility directly attached to a sophisticated surface-analysis system. The growth facility was initially set up to study the chemical aspects of interface formation during the fabrication of multilayer systems. The analysis chamber incorporates a number of novel approaches to characterizing the chemistry of these interfaces with unprecedented detail. These include LEED, XPS, angle-resolved SIMS and helium-atom diffraction. On the theoretical side, our goal was to establish extensive computational hardware and software for the modeling of the interaction of energetic particles with solids. This project involves the development of interaction potentials that accurately predict forces between atoms in materials with directional bonding such as gallium arsenide and silicon.

9450 **(CONF-860856—10) Porosity characterization in fiber-reinforced composites using ultrasonic backscatter.** Roberts, R.A. (Argonne National Lab., IL (USA)). Sep 1986. Contract W-31-109-ENG-38. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001484.

From Conference on review of progress in quantitative NDE; San Diego, CA, USA (3 Aug 1986).

The use of ultrasonic backscatter to characterize anomolous states in fiber-reinforced composites has received considerable attention in recent years. Unlike monolithic materials, ultrasonic backscatter from composites with oriented fiber reinforcement displays a strong angular dependence. Hence, three independent variables are available over which to analyze the backscatter, i.e., time, azimuthal angle, and elevation angle. Work by Bar-Cohen and Crane considered various exploitations of the angular dependence of backscatter to examine anomolies in composite laminates such as fiber misalignment, cracks, and porosity. Several efforts employing similar approaches have since followed. In this paper, specific questions are addressed concerning the angular dependence of backscatter, and the subsequent use of this angular dependence to assess porosity levels. Additionally, problems inherent in the analysis of the temporal behavior of backscatter are discussed, and an approach to the spectral analysis of backscatter for porosity assessment is demonstrated.

9451 **(CONF-861111—16) Separation of crystal-field levels and phonons in Pr dideuteride using polarized neutrons.** Arons, R.R.; Cable, J.W.; Nicklow, R.M. (Oak Ridge National Lab., TN (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003010.

From Conference on magnetism and magnetic materials; Baltimore, MD, USA (17 Nov 1986).

Polarized neutrons with polarization analysis are used for the first time successfully for distinguishing crystal-electric-field (CEF) excitations from phonons by investigating both the spin-flip and non-spin-flip cross sections. It is shown that the 20 MeV peak in Pr dideuteride, observed previously with unpolarized neutrons, arises from CEF excitations. Since this energy is nearly half the value of the CEF level at 41 MeV known before, the 20 MeV peak is composed of two contributions. At low temperatures it only arises from transitions from the ground state into the 20 MeV level. At room temperature, on the other hand, the 20 MeV level is thermally populated, so that transitions from the 20 MeV into the 41 MeV level are also obtained. This leads to the unexpected increase of the intensity of the 20 MeV peak at increasing temperatures observed previously. The present result gives a strong contribution to the knowledge of the CEF parameters of the Pr^{3+} ions in PrD_2.

9452 **(INDC(NDS)—179/G, pp 13-18) SPECTER computer code for radiation damage calculations.** Greenwood, L.R. (Argonne National Lab., IL, USA). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

The SPECTER computer code has been developed at Argonne over a number of years to routinely calculate radiation damage parameters for materials irradiations. The code will provide users with spectral-averaged displacement damage, gas production, total energy deposition (Kerma), and recoil atom energy distributions for 38 elements spanning the periodic table. The code is designed with a minimum of user input, basically just the neutron energy spectrum with uncertainties, if available. The computer code has recently been documented in an Argonne report which contains a description of the theory as well as tables and graphs of calculated displacement cross sections. In summary, the SPECTER computer code package provides users with a fast, simple method for determining radiation damage parameters for a specified neutron irradiation. The code will predict both damage rates and total damage for a specified length of irradiation. The code agrees very well with other programs, such as NJOY; however, SPECTER is not intended to be as comprehensive in its scope. One advantage of SPECTER is that it is completely self-contained and requires no access to ENDF/B-V. Furthermore, since SPECTER contains complete recoil atom energy distributions, users can in principle use these distributions directly to test other damage models if desired. 5 refs, 4 figs, 1 tab.

9453 (INIS-mf—10512, pp 22) **Critical dynamical phenomena in molecular crystals, investigated by incoherent and coherent neutron scattering and NMR.** Lechner, R.E. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H., Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9454 (INIS-mf—10512, pp 43) **Three-state model with detrapping for evaluation of positron annihilation experiments.** Puff, W. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9455 (INIS-mf—10512, pp 52) **Positron lifetime investigation of second order phase transitions in polytetrafluoroethylenes.** Kindl, P.; Reiter, G. (Technische Univ., Graz, Austria. Inst. fuer Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9456 (INIS-SU—353, pp 13-17) **Specific features of cathodoluminescence of cadmium sulfide monocrystals irradiated by protons.** Bogdankevich, O.V.; Georgobiani, A.N.; Dyukov, V.G. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780034.

Kratkie Soobshcheniya po Fizike.; (No. 6).

In Experimental and theoretical physics. Collection.

Cathodoluminescence of cadmium sulfide monocrystals irradiated by 150 keV protons was studied. It is shown that after proton irradiation intensty of exciton and end bands of cathodoluminescence strongly decreases and a wide red band appears that hasn't been observed in the initial material. This band extreme position depends on implanted proton dose, i.e. with the dose increase from 10^{13} cm^{-2} to 10^{16} cm^{-2} maximum from 700 nm is shifted into a more short-wave region. Besides, effect of Esub(e) >= 10 keV electron probe of scanning electron microscope (SEM) with the dose of approximately 10^{18}-10^{19} cm^{-2} on cathodoluminescence of samples irradiated by protons is studied. It is shown that intensity of cathodoluminescence of these local regions affected by electrons sufficiently increases. Effect of electron probe is conserved for long period. Contrast of the image read in SEM cathodoluminescence regime is not softened three-four months later after electron irradiation. 3 refs.

9457 (INIS-SU—354, pp 8-11) **Edge photoluminescence of gallium and indium ion irradiated CdS.** Georgobiani, A.N.; Gruzintsev, A.N.; Ilyukhina, Z.P.; Spitsyn, A.V.; Tiginyanu, I.M. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike.; (No. 11).

In Plasma physics. Collection.

The effect of irradiation by gallium and indium ions on cadmium sulfide green photoluminescence (PL) spectrum is investigated. CdS monocrystal samples of conductivity n-type have been irradiated by gallium and indium ions with 150 keV energy at 10^{15} cm sup(-2) dose. Upon implantation the samples have been annealed during 20 min in the Ar flow at 300 deg C. PL has been excited by the 365 nm line of a mercury lamp.The CdS PL spectra have been investigated in the 6-80 K temperature range. It is shown that In and Ga implantation causes an increase of PL various band intensity in cadmium sulfide green region. In case of gallium alloying d-band predominates, of indium enrichment - K-band. 8 refs.; 2 figs.

9458 (INIS-SU—361, pp 36-41) **Analysis of infrared reflection long wave spectra of Cdsub(1-x)Hgsub(x)Te solid solution systems by Kramers-Kronig method.** Milokhin, A.E.; Vodop'yanov, L.K. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780036.

Kratkie Soobshcheniya po Fizike.; (No. 8).

In Experimental and theoretical physics. Collection.

Using model-independent analysis of Kramers-Kronig method reflection spectra of solid solutions Cdsub(1-x)Hgsub(x)Te (0 < x <= 0.8) in the range of wave lengths from 100 to 200 cm^{-1} are studied. Frequencies of basic and cluster phonon modes are found. A good agreement with the previously reported data is obtained. 6 refs.; 3 figs.

9459 (INIS-SU—361, pp 16-20) **Photoluminescence and optical absorption in nickel ion irradiated a-SIH.** Akimchenko, I.P.; Karryev, A.N.; Vavilov, V.S.; Gippius, A.A. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780036.

Kratkie Soobshcheniya po Fizike.; (No. 8).

In Experimental and theoretical physics. Collection.

Photoluminescence and optical absorption in nickel ion irradiated and annealed a-Si:H films are investigated. It is concluded that nickel atoms are capable of compensating defects responsible for localized states in forbidden zone a-Si:H. 4 refs.; 3 figs.

9460 (INIS-SU—361, pp 7-10) **Low temperature polymorphism in Pbsub(0,78)Snsub(0,22)Te-In system.** Aleksandrov, O.V.; Kiseleva, K.V. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780036.

Kratkie Soobshcheniya po Fizike.; (No. 8).

In Experimental and theoretical physics. Collection.

X-ray diffractometric study of polycrystals in Pbsub(0.78)Snsub(0.22)Te-In system in the temperature range from 10 to 300 K allowed to state symmetry of their low-temperature polymorphous modifications and to calculate the parameters of new phase crystal lattices. 5 refs.; 1 fig.; 1 tab.

9461 **(IS-T—1245) Josephson and quasiparticle tunneling studies of $LiTi_2O_4$.** Ng, K.W. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 119p. NTIS, PC A06/MF A01; GPO Dep. File Number DE87003045.

Josephson point contact tunneling between $LiTi_2O_4$ and Nb reveals, under K-band microwave radiation of frequency nu = 25.2 GHz, Shapiro steps of spacing approximately h nu/2e. Assuming the validity of the analysis of Pals and van Haeringen, we were led to the conclusion that the pairing in superconducting $LiTi_2O_4$ was of the s-wave type, as in Nb. The "squeezable junction" method of Moreland and Hansma has been applied to study the superconducting energy gap of an arc melted bulk $LiTi_2O_4$ sample and also of co-sputtered MoRe films. The MoRe film was estimated to have an energy gap of 1.05 mV, corresponding to a Re concentration of 17%. The engery gap of $LiTi_2O_4$ is determined to be 1.95 +- 0.03 mV corresponding to 2Δ/k/sub B/T/sub c/ = 4.00 +- 0.06, making this material a conventional, electron-phonon strong coupled superconductor. The new results for $LiTi_2O_4$ rule out the recent suggestion of Alexandrov and Ranninger that this material might exhibit a bipolaronic form superconductivity, for such a form would be gapless, contrary to our results.

9462 **(IS-T—1250) X-ray diffraction characterization of CdTe epitaxial layers on GaAs substrates as a function of temperature.** Horning, R.D. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 186p. NTIS, PC A09/MF A01; GPO Dep. File Number DE87003047.

X-ray diffraction methods have been used to study the structural and thermal properties of CdTe epitaxial layers on GaAs substrates. Precession photography revealed twin faults in (1,1,1) oriented CdTe epilayers. Measurements of the Bragg reflections between 10 and 360°K reveal anomalous behavior in the lattice parameters of both the substrate and the epilayer in a (0,0,1) oriented sample deposited at 410°C. The overall change in the CdTe lattice parameter in this temperature range was about five times larger than in bulk CdTe, and the change in the substrate lattice parameter was about three times the bulk value. These anomalies were absent in a similar sample deposited at 380°C. Similar measurements were made on GaAs and CdTe single crystals. The Debye temperatures derived from perpendicular reflections are 250°K for the GaAs substrates and 142°K for the CdTe epilayers. These are the same as for single cyrstals of GaAs and CdTe. The Debye temperatures from reflections not perpendicular to the surface are significantly lower. The Debye theory and the One-Particle Potential model are used in the above analyses. The Debye-Einstein theory does not explain the observed behavior any better than the Debye theory. 140 refs., 53 figs.

9463 (Juel-Spez—316, pp 53-54) **Proof of the incommensurate phase of AlPO$_4$ by elastic neutron diffraction.** Arnold, H.; Bethke, J.; Eckold, G.; Hahn, T. (Technische Hochschule Aachen, Germany, F.R. Lehrstuhl und Inst. fuer Kristallographie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9464 (Juel-Spez—316, pp 60-62) **Phase transformations in K(Zn,Mn)F$_3$ mixed crystals.** Lehner, N.; Rauh, H.; Kullmann, W.; Geick, R.; Eckold, G.; Heger, G. (Institut Max von Laue - Paul Langevin, 38 - Grenoble, France; Wuerzburg Univ., Germany, F.R. Physikalisches Inst.; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung; Technische Hochschule Aachen, Germany, F.R. Lehrstuhl und Inst. fuer Kristallographie; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Angewandte Kernphysik 1). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9465 (Juel-Spez—316, pp 63-68) **Lattice dynamics of matrix structures.** Eckold, G.; Hahn, T.; Hildmann, B.O. (Technische Hochschule Aachen, Germany, F.R. Lehrstuhl und Inst. fuer Kristallographie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

MLiSO$_4$ (with M=K, Cs, ND$_4$) belong to the class of tetrahedral matrix structures. In all of these substances disorder phenomena exist. In the present project it is investigated, how the lattice dynamics is influenced by this disorder. Measurements were performed by neutron diffraction and compared to a rigid ion model. (BHO).

9466 (Juel-Spez—316, pp 72-74) **Investigations of the molecular dynamics of oligomer dimethylsiloxanes.** Alefeld, B.; Prager, M.; Grapengeter, H.H.; Kosfeld, R. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung; Hamburg Univ., Germany, F.R. Inst. fuer Physikalische Chemie; Duisburg Univ., Gesamthochschule, Germany, F.R. Fachgebiet Physikalische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9467 (Juel-Spez—316, pp 84-89) **Elementary steps of the Ag$^+$-self-diffusion in α-AgI and α-Ag$_2$Se - a comparison based on quasielastic neutron diffraction experiments for big monocrystals.** Funke, K.; Hoech, A.; Lechner, R.E.; Ohachi, T.; Ewald, J.P. (Hannover Univ., Germany, F.R. Inst. fuer Physikalische Chemie und Elektrochemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The high temperature phases of AgI and Ag$_2$Se belong to the prototypes of solid ionic conductors. In the present project the dynamics of the Ag$^+$ self-diffusion in α-AgI and α-Ag$_2$Se has been investigated by scattering of cold neutrons. (BHO).

9468 (Juel-Spez—316, pp 104-106) **Neutron small angle scattering at periodically deformed polymers.** Rennie, A.R.; Fischer, E.W.; Ewen, B.; Oberthuer, R.C. (Mainz Univ., Germany, F.R. Inst. fuer Physikalische Chemie; Max-Planck-Institut fuer Polymerforschung, Mainz, Germany, F.R.; Institut Max von Laue - Paul Langevin, 38 - Grenoble, France). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The small angle neutron scattering from periodically deformed polymers can be measured with the aid of a new dynamic stretching apparatus. First results for this investigation in new space and time domains have provided useful data about relaxations in rubbers.

9469 (Juel-Spez—316, pp 107-110) **Polyurethane elastomers, marked by deuterium, with mono-disperse hard segment length distribution for neutron scattering experiments.** Eisenbach, C.D.; Guenter, C.; Struth, U. (Karlsruhe Univ., T.H., Germany, F.R. Polymer-Institut; Freiburg Univ., Germany, F.R. Inst. fuer Makromolekulare Chemie; Mainz Univ., Germany, F.R. Inst. fuer Physikalische Chemie.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9470 (Juel-Spez—316, pp 111-118) **Anisotropy of n-alkanes in stretched polymer melts.** Sautter, E.; Pechhold, W. (Ulm Univ., Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

By means of the scattering behaviour of short marked chain molecules the short-range order in the polymer melt can be investigated. Thus neutron diffraction experiments were performed and reciprocal structure factory of a concentration serie of n-alkane $C_{24}H_{50}$ dissolved in deuterated polyethylene and of oligostyrene dissolved in d-polystyrene are presented. (BHO).

9471 (Juel-Spez—316, pp 119-123) **Molecule conformation, segregation and transesterification in polyethyleneterephtalate.** Wiswe, D.; Gilmer, J.W.; Zachmann, H.G.; Hahn, K.; Kugler, J.; Fischer, E.W.; Wu, W. (Hamburg Univ., Germany, F.R. Inst. fuer Technische und Makromolekulare Chemie; Mainz Univ., Germany, F.R. Inst. fuer Physikalische Chemie; National Bureau of Standards, Washington, DC, USA). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

Neutron diffraction is performed for deuterated polyethylene terephthalate. Amorphous samples were produced by mixing deuterated and nondeuterated material in solution and segregation, melting and quenching afterwards. It is shown that because of a transesterification a block copolymer is produced, which consists of deuterated and protonated chain parts. (BHO).

9472 (Juel-Spez—316, pp 182-185) **Works at the Austrian triple-axis spectrometer at the Orphee reactor.** Weinzierl, P. (Vienna Univ., Austria. Inst. fuer Experimentalphysik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

Two investigations at this instruments are reported: 1) The ordering states in PdDsub(x) at low temperatures; 2) The martensitic phase transitions in RbJ at 3.65 kbar and in Na at 36 K. (BHO).

9473 (Juel-Spez—316, pp 206-208) **Application of neutron diffraction to texture investigations.** Hoefler, S.; Schaefer, W.; Will, G. (Bonn Univ., Germany, F.R. Mineralogisch-Petrologisches Inst. und Museum; Bonn Univ., Juelich, Germany, F.R. Aussenstelle fuer Neutronenbeugungsforschung). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9474 (Juel-Spez—316, pp 232-233) **Neutron diffraction at insulating spin glasses.** Wiedenmann, A.; Gunsser, W. (Hamburg Univ., Germany, F.R. Inst. fuer Physikalische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9475 (Juel-Spez—316, pp 244-249) **Neutron diffraction in crystal chemistry, mineralogy and magnetism.** Fuess, H.; Erfany, H.; Joswig, W.; Koerfer, M.; Lottermoser, W.; Mueller, R.; Schweiss, B.P.; Stuckenschmidt, E. (Frankfurt Univ., Germany, F.R. Inst. fuer Kristallographie und Mineralogie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article reports on the magnetic structures of synthetic olivines, on inelastic neutron diffraction at the natural zeolithe Harmotom and on the investigation of a structural phase transformation at $CH_3NH_3HgCl_3$. (BHO).

9476 (Juel-Spez—316, pp 257-258) **Magnetic ordering in the quasi-two-dimensional system VOCl.** Wiedenmann, A.; Gunsser, W. (Hamburg Univ., Germany, F.R. Inst. fuer Physikalische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9477 (Juel-Spez—316, pp 259-262) **Neutron diffraction and magnetic measurements at tetrametaphosphates.** Rohwer, K.; Wiedenmann, A.; Gunsser, W. (Hamburg Univ., Germany, F.R. Inst. fuer Physikalische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The tetrametaphosphates of Cu, Ni, Co and Mn are investigated for the crystal structure, preparation conditions, magnetic properties and by neutron diffraction. (BHO).

9478 (Juel-Spez—316, pp 268-271) **Structure and magnetic properties of Tl-Fe-S compounds.** Welz, D.; Deppe, P.; Rosenberg, M.; Sabrowsky, H.; Schaefer, W. (Bochum Univ., Germany, F.R. Inst. fuer Experimentalphysik; Bochum Univ., Germany, F.R. Inst. fuer Anorganische Chemie 1; Bonn Univ., Germany, F.R. Mineralogisch-Petrologisches Inst. und Museum). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9479 (Juel-Spez—316, pp 272-275) **Antiferromagnetic structure of $LaFeO_3$.** Peterlin-Neumaier, T.; Steichele, E. (Technische Univ. Muenchen, Garching, Germany, F.R. Fakultaet fuer Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9480 (Juel-Spez—316, pp 240-243) **Investigations at $Rb_2(Mn,Cr)Cl_4$ mixed crystals.** Kullmann, W.; Grieb, T.; Strobel, K.; Rauh, H.; Geick, R.; Treutmann, W.; Naumann, E.; Heger, G.; Higgins, S.; Cowley, R.A. (Wuerzburg Univ., Germany, F.R. Physikalisches Inst.; Marburg Univ., Germany, F.R. Inst. fuer Mineralogie, Petrologie und Kristallographie; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Angewandte Kernphysik 1; Edinburgh Univ., UK. Dept. of Physics). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9481 **(KURRI-TR—247) Proceedings of the study meeting on radiation effect of insulation materials.** Ito, Noriaki; Yoshida, Hiroyuki; Nakagawa, Masuo (eds.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.; Nagoya Univ. (Japan). Faculty of Engineering; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1984. 72p. (In Japanese). (CONF-8212114—). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780041.

From Study meeting on radiation effect of insulation materials; Kumatori, Osaka, Japan (13 Dec 1982).

Individual items for the data base are processed separately. (DLC)

9482 (KURRI-TR—249, pp 57-64) **Coloration of cadmium halide crystals due to reactor irradiation at low temperature.** Nakagawa, Hideyuki; Matsumoto, Hiroaki; Yugami, Hiroo; Yamada, Takanobu; Nakagawa, Masuo. (Fukui Univ., Japan. Faculty of Engineering). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

The optical absorption spectra and ESR spectra of cadmium halide crystals were measured after the reactor irradiation at low temperature to study the coloration. The irradiated neutron dose was about 5×10^{17} n/cm^2. In the measurement of ESR spectra, the crystal was rotated around the v-axis (the two-fold axis) in the magnetic field of fixed direction. The optical absorption spectra showed that the Cd^{3+} center was generated. From the analysis of the angular dependence of ESR spectra, the centers of C(2h) symmetry and the centers of D(3d) symmetry were considered to be generated. The models of these centers were considered, and the angular dependence was analyzed. It can be concluded from the present experiment that the coloration of cadmium halide crystals is recognized as the results of the reactor irradiation at low temperature.

9483 (KURRI-TR—263) **Proceedings of a symposium (short term research meeting) on research of semiconductors with research reactors.** Kimura, Itsuro (ed.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1985. 76p. (In Japanese). (CONF-8501101—). NTIS (US Sales Only), PC A05/MF A01. File Number DE87700246.

From Symposium on research of semiconductors with research reactors; Kumatori, Osaka, Japan (21 Jan 1985).

This is a proceeding of a symposium (short term research meeting) on research of semiconductors with research reactors held at the Research Reactor Institute, Kyoto University on January 21 and 22 in 1985. At first an introductory talk on reactor neutron fields and semiconductors was given. Then there were four sessions as following: (1) Structure analysis by neutron diffraction. (2) Impurity measurements by neutron activation analysis, radioactive tracer technique and solid state track detector technique. (3) Neutron transmutation doping. (4) Irradiation effects of semiconductor materials and devices.

9484 (N—86-31665) **Composite structural materials. Annual progress report, 1 May 1985-30 April 1986.** Loewy, R.; Wiberley, S.E. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Aug 1986. 119p. (NASA-CR—179659; NAS—1.26:179659; REPT—49). NTIS HC A06/MF A01.

Overall emphasis is on basic long-term research in the following categories: constituent materials, composite materials, generic structural elements, processing science technology; and maintaining long-term structural integrity. Research in basic composition, characteristics, and processing science of composite materials and their constituents is balanced against the mechanics, conceptual design, fabrication, and testing of generic structural elements typical of aerospace vehicles so as to encourage the discovery of unusual solutions to present and future problems. Detailed descriptions of the progress achieved in the various component parts of this comprehensive program are presented.

9485 (N—86-31858) **Densitometric analysis of IIaO film flown aboard the space shuttle transportation system STS-3, STS-8, and STS-7. Semiannual report, December 1986.** Hammond, E.C. Jr.; Peters, K.A.; Atkinson, P.F. (Morgan State Univ., Baltimore, MD (USA)). 1986. 23p. (NASA-CR—176864; NAS—1.26:176864). NTIS HC A02/MF A01.

Three canisters of IIaO film were prepared along with packets of color film from the National Geographic Society, which were then placed on the Space Shuttle #3. The ultimate goal was to obtain reasonably accurate data concerning the background fogging effects on IIaO film as it relates to the film's total environmental experience. This includes: the ground based packing, and loading of the film from Goddard Space Flight Center to Cape Kennedy; the effects of the solar wind, humidity, and cosmic rays; the Van Allen Belt radiation exposure; various thermal effect; reentry and off-loading of the film during take off, and 8 day, 3 hour 15 minutes orbits. The total densitometric change caused by all of the above factors were examined. The results of these studies have implications for the utilization of IIaO spectroscopic film on the future shuttle and space lab missions. These responses to standard photonic energy sources will have immediate application for the uneven responses of the film photographing a star field in a terrestrial or extraterrestrial environment with associated digital imaging equipment.

9486 (N—86-32268) **Infrared attenuation of thallium bromo-iodide fibers.** Magilavy, B.; Goebel, J. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Feb 1986. 27p. (NASA-TM—86817; A—85370; NAS—1.15:86817). NTIS HC A03/MF A01.

Analysis of attenuation measurements in the near infrared of an unclad fiber of thallium bromoiodide (Th(Br,I)), a polycrystalline thallium halide, is presented. A general overview is given of the properties of fiber optics. Two groups of attenuation measurements, for the region 1.2 to 3.4 and for 3 to 11 microns, respectively, are presented, analyzed, and compared with those of two other groups of researchers.

9487 (N—86-32573) **Milling of pristine and brominated P-100 graphite fibers.** Dillehay, M.E.; Gaier, J.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Sep 1986. 12p. (NASA-TM—88828; E—3203; NAS—1.15:88828). NTIS HC A02/MF A01.

Techniques were developed for the ball milling of pristine and brominated P-100 graphite fibers. Because of the lubrication properties of graphite, large ball loads (50 percent by volume) were required. Use of 2-propanol as a milling medium enhanced the efficiency of the process. Milled brominated P-100 fibers had resistivities which were indistinguishable from milled pristine P-100 fibers. Apparent loss of bromine from the brominated fibers suggests that bromine would not be the intercalate of choice in applications where milled fibers of this type are required. Other intercalates which do not degas may be more appropriate for a milled fiber application. These same results, however, do provide evidence that bromine molecules leave the fiber surface when removed from overpressure of bromine. While exploring possible solvent media for milling purposes, it was found that brominated fibers are stable in a wide variety of organic solvents.

9488 (N—86-33177) **Total-dose radiation effects data for semiconductor devices. 1985 supplement. Volume 2, part A.** Martin, K.E.; Gauthier, M.K.; Coss, J.R.; Dantas, A.R.V.; Price, W.E. (Jet Propulsion Lab., Pasadena, CA (USA)). May 1986. 579p. (NASA-CR—179746; JPL-PUB—85-43-VOL-2-PT-A; NAS—1.26:179746). NTIS HC A25/MF A01.

Steady-state, total-dose radiation test data, are provided in graphic format for use by electronic designers and other personnel using semiconductor devices in a radiation environment. The data were generated by JPL for various NASA space programs. This volume provides data on integrated circuits. The data are presented in graphic, tabular, and/or narrative format, depending on the complexity of the integrated circuit. Most tests were done using the JPL or Boeing electron accelerator (Dynamitron) which provides a steady-state 2.5 MeV electron beam. However, some radiation exposures were made with a cobalt-60 gamma ray source, the results of which should be regarded as only an approximate measure of the radiation damage that would be incurred by an equivalent electron dose.

9489 (NAGRA-NTB—85-52) **Compaction tests on quartz sand-bentonite mixtures.** Bucher, F.; Jedelhauser, P. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Grundbau und Bodenmechanik). Oct 1985. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900259.

In this report the results are presented of compaction tests on quartz sand-bentonite mixtures. The selected quartz sand exhibited a steep grading curve in the range 1 to 1.5 mm. The bentonites used were those previously investigated, i.e., the Na-bentonite MX-80 and the Ca-bentonite Montigel. The mixtures were statically compacted in a compaction mould. Altogether about 80 tests were carried out, in which the bentonite content was varied between roughly 20 and 50% of the weight of sand and the compacting pressure was between 80 and 320 MN/m2. The tests showed that the pressures required to reach a given dry density of the bentonite filling the pores of the sand's grain structure were 10 to 20 times greater than those required for specimens of bentonite alone. It was also observed that the mixtures with MX-80 were easier to compact than those with Montigel. On the other hand, it was found that the specimens with MX-80 were more brittle, especially at low compacting pressures. Mixtures with 35 to 45% Montigel compacted at pressures in the range 160 to 240 MN/m2 resulted in homogeneous, compact specimens with bentonite dry densities of about 1.5 Mg/m3.

9490 (SAND—86-0531C) **Effects of temperature on the surface contamination of LiF: An electron stimulated desorption study.** Kelber, J.A. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1986. Contract AC04-76DP00789. 8p. (CONF-861019—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003038.

From 10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society; Baltimore, MD, USA (27 Oct 1986).

The conclusion is made that the LiF surface structure greatly influences the interaction of the surface with H_2O, as undissociated water was observed at the surfaces of evaporated thin films, but not single crystals. Another conclusion is that sample heating reduces surface contamination. However, the Li^+/F^+ ratio is also significantly affected.

9491 (SAND—86-1395C) **Etching of $LiNbO_3$ by laser-driven fusion of salts.** Ashby, C.I.H.; Brannon, P.J. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 6p. (CONF-861207—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003033.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Lithium niobate exhibits low reactivity with most chemical etchants. Consequently, etching a $LiNbO_3$ surface to produce optical structures such as ridge waveguides or grooves for fiber coupling normally requires relatively slow processses such as ion milling. We have developed a laser-driven chemical etching process for etching highly unreactive ionic solids based on the fusion of salts in the molten phase which can be more than 100 times faster than ion milling rates. This process involves spatially localized melting of $LiNbO_3$ by higher-power density laser pulses with photon energies in excess of the band gap of $LiNbO_3$. While molten, $LiNbO_3$ undergoes reaction with a surface coating of KF to form niobium oxyfluoride anions by fusion of the salts. The resulting solid is highly water soluble. The insolubility of $LiNbO_3$ permits subsequent removal of only the irradiated area by rinsing in water. Surface morphology is determined by laser density. The process exhibits a wavelength dependence.

9492 (SAND—86-1402C) **Photochemical dry etching of semiconductors and its relationship to semiconductor electronic properties.** Ashby, C.I.H. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 10p. (CONF-861207—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003034.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The general utility and selectivity of those photochemical dry etching processes which require direct participation of photogenerated carriers is largely determined by the electronic properties of the semiconductor. The laser which is used to produce the carriers responsible for etching can also provide in situ measurement of some of the important electronic properties which influence the etching process.

9493 **Effect of structural disorder on organic superconductors: a neutron diffraction study of high-T/sub c/ β-(BEDT-TTF)$_2$I$_3$ at 4.5 K and 1.5 kbar.** Schultz, A.J.; Wang, H.H.; Williams, J.M.; Filhol, A. (Argonne National Lab., IL). *Journal of the American Chemical Society;* **108**: No. 24, 7853-7855(26 Nov 1986). Contract W-31-109-ENG-38.

In this paper the authors report the existence of a new ordered structural phase, denoted as β^*-(ET)$_2$I$_3$, at $T = 4.5$ K and $P = 1.5$ kbar. To our knowledge, this is the first structural study of an organic superconductor with the sample at a temperature below the onset temperature for superconductivity. The structure of β^*-(ET)$_2$I$_3$ derived from the data set obtained with the sample below the superconducting transition temperature, at 4.5 K and 1.5 kbar, is completely ordered but is not isostructural with the β-phase structures of the I_2Br^-, AuI_2^-, and IBr_2^- salts.

9494 **Process for producing composite material.** Jatkar, A.D.; Varall, A.J. Jr.; Schelleng, R.D. (to Inco Alloys International, Inc., Huntington, VA). US Patent 4,623,388. 18 Nov 1986. Filed date 8 Oct 1985. v.p.

This patent describes a composite material adapted to form a compacted composite of relatively low density and high modulus comprising a powdery mass wherein particles of reinforcing phase are enveloped in and bonded to mechanically worked powders. The powders are of a ductile metal matrix selected from the group of aluminum and aluminum-base alloys the particles of reinforcing phase comprising about 0.2 to about 30 volume percent of the powder.

9495 **Radiation-hardened polymeric films.** Arnold, C. Jr.; Hughes, R.C.; Kepler, G.; Kurtz, S.R. (to Dept. of Energy, Washington, DC). US Patent 4,622,355. 11 Nov 1986. Filed date 16 Jul 1984. v.p.

This patent describes polymeric dielectric compositions with reduced radiation induced conductivity, containing from about 10/sup 15/ to 10/sup 21/ molecules/cm/sup 3/ of a compatible organic Lewis acid or Lewis base as dopant. The dielectric is a low electronic mobility polymer selected from the group consisting of polyesters, polyolefins, perfluorinated polyolefins, vinyl polymers, vinylidene polymers, polycarbonates, polysulfones, and polyimides.

9496 **Application of compositionally diphasic xerogels for enhanced densification: The system Al/sub 2/O/sub 3/-SiO/sub 2/.** Komarneni, S.; Suwa, Y.; Roy, R. (Materials Research Lab., The Pennsylvania State Univ., University Park, PA 16802). *Journal of the American Ceramic Society;* 69: No. 7, C155-C156(Jul 1986).

Stoichiometric mullite (71.38 wt% Al/sub 2/O/sub 3/-28.17 wt% SiO/sub 2/) and 80 wt% Al/sub 2/O/sub 3/-20 wt% SiO/sub 2/ gels were prepared by the single-phase and/or diphasic route. Dense sintered bodies were prepared from both sets of gels in the Al/sub 2/O/sub 3/-SiO/sub 2/ system. Apparent densities of 96% and 97% of theoretical density were measured for the diphasic (using two sols) mullite samples sintered at 1200° and 1300°C for 100 min, respectively; this compared with 85% and 94% for the single-phase xerogels under the same conditions, and to much lower values for mullite prepared from conventional mixed powders. The microstructure of the mullite pellets from diphasic xerogel precursors is also considerably finer.

9497 **Phase transformations in picosecond laser-irradiated graphite.** Huang, C.Y.; Malvezzi, A.M.; Bloembergen, N. (Los Alamos National Lab., Los Alamos, NM 87545). pp 88-90 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors have investigated the optical properties of highly oriented pyrolytic graphite by picosecond pump-probe techniques. Their results at 1.9 and 1.06 μm have shown that a new phase occurs as soon as a critical fluence F/sup th/ = 140 mJ/cm/sup 2/ is exceeded. Above this value the reflectivity drops considerably from the original value. To understand the nature of this new phase, which we identify as the liquid phase, they have performed new measurements at 532 nm. The reflectivity data at 100 ps after the irradiation are summarized for the three wavelengths investigated. Data points are shown for two different values of the input laser fluence F, i.e., F = 0 and F = 500 mJ/cm/sup 2/. Contrary to the behavior of silicon and other semiconductors, which exhibit metallic reflectivities after surface melting, the new phase in graphite is characterized by lower reflectivities in a wide wavelength range. This indicates a decrease in both the real and imaginary parts of the index of refraction. More light can, therefore, penetrate the material, thus heating further layers. This process can provide a considerable depth of transformed material much thicker than the initial absorption depth. Moreover, the thermal diffusion, which is intrinsically lower than in the metallic case, is slowed by the lower gradients so that surface evaporation will be a major cooling channel at later times.

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9498 (NP—7900249) **The Welch Foundation: Annual report, supplemental information.** (Welch (Robert A.) Foundation, Houston, TX (USA)). [1986]. 174p. Welch Foundation, 4605 Post Oak Place Drive, Suite 200, Houston, TX 77027. File Number TI87900249.

This report is a summary of the events of 1984 for the Robert A. Welch Foundation. It contains a list of the lectureship program for 1984-1985 and a list of lectureships in chemistry for 1957-1983. Those are followed by a collection of abstracts of current investigations being supported by the Foundation. (PLG)

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REFER ALSO TO CITATION(S) 9035, 9228, 9236, 9244, 9321, 9349, 9417, 9483, 9539, 9543, 9545, 9552, 9558, 9598, 9600, 9604, 9868, 9929, 9930, 9933, 10043, 10086, 10101, 10101, 10622

9499 (CEA-R—5340) **CEA nuclear microprobe. Description, possibilities, application examples.** Engelmann, C.; Bardy, J. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). May 1986. 45p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750739.

The nuclear microprobe installed on one of the beam lines of a 4 MV Van de Graaff located in the Research Center of Bruyeres-le-Chatel is described. The various possibilities, particularly the imaging system, and the performances of the instrument are exposed. Two typical application examples concerning, the first, the determination of the deuterium and tritium in glass microballons, the second, the detection and the localization of carbon and oxygen in the superficial layer of lithium hydride pellets, are given. Preliminary results of some other application examples are also presented. The advantages of the nuclear microprobe over the other ponctual analysis techniques are emphasized. 7 refs, 19 figs.

9500 (CONF-860796—1) **Separation and recovery of metal ions by supported liquid membranes: science and applications.** Reichley-Yinger, L. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001530.

From International symposium on metal speciation, separation and recovery; Chicago, IL, USA (27 Jul 1986).

The concept of using supported liquid membranes (SLMs) for the separation of metal species was first proposed approximately twenty years ago to eliminate some of the difficulties associated with liquid-liquid extraction. Liquid-liquid extraction is particularly well suited to the separation of metal ions in aqueous solutions because of the large variations in distribution ratios that exist for different metal ions. Separations by SLMs have all the advantages of liquid-liquid extraction as well as the following potential advnatages: (a) loss of extractant by entrainment is greatly reduced, (b) high concentration factors can be achieved in a single stage, (c) extractant inventory is very low, and (d) small amounts of energy and space are required. The presented paper will review the theory developed, describe apparatuses used, give examples of applications, and speculate on the future of SLMs in the separation and recovery of metal ions. 15 refs., 15 figs.

9501 (CONF-860911—20) **Experimental studies of transplutonium metals and compounds under pressure.** Peterson, J.R.; Haire, R.G.; Benedict, U.; Young, J.P. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Chemistry; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). 1986. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002421.

From 192. American Chemical Society national meeting; Anaheim, CA, USA (7 Sep 1986).

The structural behavior of the first four transplutonium metals and two Bk-Cf alloys as a function of pressure has been studied in diamond anvil cells via x-ray diffraction. The sequence of structures exhibited as pressure is increased is dhcp → ccp → orthorhombic. In addition a distorted ccp phase is observed in Am, Bk/sub 0.40/Cf/sub 0.60/, and Cf between the ccp and orthorhombic phases. Diamond anvil cells have also been used to contain AmI_3, $CfBr_3$, and $CfCl_3$ under pressure for investigation by absorption spectrophotometry. Both AmI_3 and $CfBr_3$ exhibit pressure-induced, irreversible phase transformations to the $PuBr_3$-type orthorhombic structure, a more dense form of these compounds. Thus the driving force for these transformations is more efficient crystal packing. Both hexagonal (to 22 GPa) and orthorhombic (to 35 GPa) $CfCl_3$ exhibit only reversible spectral changes with pressure. This probably reflects their nearly identical RTP unit cell volumes. In both cases the spectra obtained are consistent with a continuous alteration of the RTP structure with pressure; physical compression seems to make a given f-f transition easier. Additional data are being sought to elucidate more completely the behavior of $CfCl_3$ under pressure. 23 refs., 4 figs.

9502 (GSO—1985-0096, pp vp) **Characterisation of South African coals using instrumental neutron activation analysis.** Hart, R.J. (Cape Town Univ., South Africa. Dept. of Geochemistry). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

This report includes the establishment of the major, minor and trace element compositions of South African coals with the aim of characterising the different coal seams within a basin, defining regions of similar compositions and obtaining an overall view of the geochemistry of coals in this country. The results of 40 coal samples analysed by neutron activation analysis.

9503 (IAEA-RL—134) **JASPAS program task JC-4 isotopic and isotope dilution analysis of spent fuel solutions by resin bead mass spectrometry. Results of the fifth PNC-IAEA experiment.** Onishi, K.; Terakado, S.; Kuno, Y.; Kamata, M.; Kaminaga, K.; Abe, K.; Donohue, D.; Fiedler, R.; Deron, S. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Aug 1986. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700256.

The results of all experiments to date have shown that the resin bead technique is capable of achieving precision and accuracy of better than 0.5% for U and Pu content of spent fuel solutions. The present experiment serves to reinforce this conclusion and to provide further operating experience with the technique. This exercise has demonstrated that the resin bead method can be successfully applied to the measurement of safeguard samples with precision and accuracy approaching that of conventional mass spectrometry. 4 refs, 1 fig, 6 tabs.

9504 (INIS-mf—10511, pp 140) **Segregation of impurities during the sintering process of thoria.** Reetz, T.; Naepe, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden, German Democratic Republic). Apr 1985. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780030. (CONF-8504277—).

From International symposium on systems with fast ion transport; Smolenice, Czechoslovakia (1 Apr 1985).

9505 (INIS-mf—10511) **International symposium on systems with the fast ionic transport.** (Ceskoslovenska Vedeckotechnicka Spolocnost, Bratislava. Dom Techniky; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Apr 1985. 5p. (CONF-8504277—). NTIS (US Sales Only), PC A02/MF A01. File Number DE87780030.

From International symposium on systems with fast ion transport; Smolenice, Czechoslovakia (1 Apr 1985).

Separate papers in this report have been indexed individually.

9506 (JAERI-M—85-038) **Collaborative analysis for certification of zirconium and zirconium base alloy reference materials JAERI-Z11 to Z16.** (Japan Atomic Energy Research Inst., Tokyo). Mar 1985. 128p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87700257.

The second Sub-Committee on Zircaloy Analysis was organized in April 1978, under the Committee on Analytical Chemistry on Nuclear Fuels and Reactor Materials, JAERI, for the renewal of zirconium and zirconium base alloy certified reference materials (CRMs). The Sub-Committee carried out collaborative analysis among 13 participating laboratories for the certification of the CRMs, JAERI-Z11 to Z18, after development, improvement and evaluation of analytical methods during the period of May 1978 to June 1982. As the result of the collaborative analysis, the certified value was given for 18 elements (Sn, Fe, Ni, Cr, B, Cd, U, Cu, Co, Mn, Pb, Al, Ti, Si, Mo, W, Hf, C) in the CRMs. The first part of this report includes general discussion, the second part principles of certification, the third part development and verification of analytical methods, and the fourth part evaluation of analytical results on 17 elements. Preparation of Z11 to Z18, and certification for carbon in JAERI-Z17 and Z18 were reported separately in JAERI-M 83-241 and M 83-035, respectively.

9507 (ORNL/TM—10190) **Application of solid sorbent collection techniques and high performance liquid chromatography with electrochemical detection to the analysis of explosives in water samples: Final report.** Maskarinec, M.P.; Manning, D.L.; Harvey, R.W. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002973.

Methods were developed for the determination of several explosives components (nitro-organic compounds) in environmental waters. The methods are based on Porapak resin adsorption and Amberlite XAD-4 resin adsorption of the explosives components from aqueous samples. Following desorption with acetone, the explosives are measured by high performance liquid chromatography with electrochemical detection. The technique provides a high degree of selectivity and sensitivity for these compounds in actual samples. Detection limits approach 1 μg/l for many components.

9508 (PNL-SA—13885) **Capillary supercritical fluid chromatography-mass spectrometry (SFC-MS).** Kalinoski, H.T.; Udseth, H.R.; Chess, E.K.; Smith, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 23p. (CONF-8610175—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002712.

From 4. symposium on liquid chromatography-mass spectrometry; Montreux, Switzerland (22 Oct 1986).

The physical and chemical characteristics of supercritical fluids have prompted the development of supercritical fluid chromatography (SFC) for the analysis of labile and less volatile compounds. High resolution chromatographic separations with efficiencies approaching those of gas chromatography and high speed analyses are possible in capillary SFC using pressure programming methods and narrow bore columns. Further refinement of the SFC-mass spectrometry interface (SFC-MS) provides the basis for extension to more polar fluid systems with greater solvating power and the selectivity and sensitivity of mass spectrometric detection. The use of polar modified fluids has been facilitated by advances in understanding of supercritical fluid phase behavior. Fluid mixtures have been prepared for analysis of more polar, higher molecular weight analytes, that allow mild chromatographic temperatures and allow full exploitation of selectivity offered through control of fluid pressure (i.e., density). Continuing development of the SFC-MS interface has led to designs which can be near routinely applied with fluids such as CO_2, and providing enhanced transport of truly nonvolatile compounds to the mass spectrometer ionization regions. These advances also include an SFC interface to a high resolution, dual electric magnetic sector instrument, allowing supercritical fluid solvents to be explited for on-line extraction-mass spectrometry for characterization of complex, often otherwise intractable, materials. 26 refs., 5 figs., 1 tab.

9509 (PPA-BEN—3, pp 41-57) **Applications of neutron activation analysis in industry.** Zaini Hamzah. 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

Neutron activation analysis technique is discussed in brief. This technique is used for quality control of raw materials, process materials and finished products, as well as activities in research and development for the improvement of the products and new products. The uses of this technique in several experienced industries are mentioned.

9510 (PPA-BEN—3, pp 82-89) **Nuclear activation analysis of vanadium in biological samples.** Hori, R. (National Univ. of Singapore. Dept. of Zoology). 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

The vanadium content of the eggs and embryos of a solitary ascidian, Halocynthia roretzi, was determined by nuclear activation analysis. The determination was performed by the comparison of the activity around the 1.434-MeV peak of ^{52}V in the samples to that of the standard. In order to eliuninate the interference from ^{55}Mn (n,p) ^{52}V and from ^{52}Cr(n,p)^{52}V reactions caused by fast neutrons, the sample and standard were irradiated with and without cadmium foil wrapping. The results show that the interference of these reactions may be negligible for the determination of vanadium in the case of the ascidian. The concentration of vanadium in the eggs remained unchanged during the cleavage stage and the animal progressively accumulated in the early embryogenesis. The content in the larvae after metamorphosis amounted to nearly fifteen times of that of the unfertilized egg. The relationship between vanadium and its role in the respiration of ascidian was discussed with the presence of the experimental results

9511 (PPA-BEN—3, pp 128-140) **Application of neutron activation analysis in environmental study.** Sukiman Sarmani. (National Univ. of Malaysia, Bangi, Selangor. Dept. of Nuclear Science). 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

Neutron activation analysis is suitable in metal element pollution studies for the determination of the quality, sources, behavior and distribution of the pollutants in the biosphere. The analysis technique as an instrumentation has detection limits in mg/kg and analysis sensitivity can be improved by radiochemistry separation. Usually, the elements such as As, Cd, Hg Sb Se and Zn can be analyzed, but with the optimum technique 30-40 elements can be quantitatively analyzed in the sample. This paper briefly presents the neutron activation analysis technique in air and water pollution studies. The definition of the danger of the pollutions is also presented. 61 references were given

9512 (PPA-BEN—3, pp 142-149) **Radionuclidic purity quality control in the neutron activation of molybdenum.** Mat Rashid Mat Jaais. 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

The paper discusses radionuclide quality control in the neutron activation of molybdenum. The nuclear reaction is thus producing Mo-99 for Tc-99m production. The Tc-99m then shall be used in nuclear medicine. Generally, the paper discusses the radionuclidic impurities in neutron activation of molybdenum target which contain traces of impurities. Specially observed radionuclidic impurities Re-188 and Re-186 become a serious problem to the researchers which cannot easily be solved. Further, the paper also discusses the radionuclidic quality control procedures of Mo-99/Tc-99m where the radionuclidic impurities were decontaminated effectively by solvent extraction process.

9513 (PPA-BEN—3, pp 159-176) **Neutron Activation Analysis sensitivity - an evaluation.** Baharudin Yatim. (National Univ. of Malaysia. Bangi, Selangor. Dept. of Physics). 1985. (In Malay). NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

Neutron Activation Analysis (NAA) has been accepted as a method for multielemental analysis capable of very high sensitivity, in the range of ppb. Its sensitivity in ppm range is achievable routinely. However, this technique includes in its procedure aspects which are not universal to all laboratories and to a large extent relies on personal skill and intuition. This necessitates regular interlaboratory comparisons in order to maintain standardisation of results. In this paper results of some measurements made on various samples are reported and suggestions are given for assurance of standardisation of results.

9514 (PPA-BEN—3, pp 90-103) **Neutron activation analysis of trace elements in plants and soils.** Che Seman Mahmood; Mohd Suhaimi Hamzah; Abu Talib Bacik. (Nuclear Energy Unit, Bangi, Selangor, Malaysia; Rubber Research Inst. of Malaya, Kuala Lumpur, Malaysia). 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

Trace elements analysis is currently being introduced for plants and soils characterisation study. The Neutron Activation Analysis (NAA) technique, due to its high sensitivity for many elements and multi-element capability, offers a powerful analytical technique for this area. Information on plants and soils compositions can easily be provided using this technique.

9515 (PPA-BEN—3, pp 26-40) **NAA facilities, future activities and planning at UTN.** Abdul Khalik Haji Wood. 1985. (In Malay). NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

The paper describes the NAA technique and its facilities at Unit Tenaga Nuklear. The past and future activities of the analytical chemistry services group are also briefly described.

9516 (PPA-BEN—3) **Proceedings of a workshop on scope and technical application of neutron activation analysis held at Nuclear Energy Unit, Bangi, Selangor (MY), 5-6 February 1985.** (Unit Tenaga Nuklear, Bangi, Selangor (Malaysia)). 1985. 185p. (CONF-8502142—). NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031.

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

Individual papers in this report have been abstracted separately.

9517 (SAND—85-7258) **RHIC [Radiation Hardened Integrated Circuit] 2 building deionized water system specification for Sandia National Laboratories, Albuquerque, NM.** Scofield, J.P.; Fry, G.S.; Weaver, D.L.; Brown, N.E. (Scofield (Jan P.), San Antonio, TX (USA); Integrated Circuit Engineering Corp., Scottsdale, AZ (USA); Sandia National Labs., Albuquerque, NM (USA)). Aug 1986. Contract AC04-76DP00789. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003089.

The specification for a 150 gpm ultrapure water system has been written to support the development of radiation tolerant submicron silicon integrated circuit technologies and designs of the 1990's in the new Radiation Hardened Integrated Circuit (RHIC) facility at Sandia National Laboratories, Albuquerque. The design, based on comprehensive analyses of the high silica (20 to 40 ppM) well water, the operating experience with an existing 55 gpm system, and the expertise of a broad spectrum of engineering and manufacturing consultants, was documented for system procurement, fabrication, installation, and performance testing in an 80 page specification. The emphasis of the system design was on low maintenance, high reliability operation through the use of proven water purification technology, controls and monitoring automation, and extensive instrumentation to detect operational changes prior to a change in product water quality.

9518 (UCRL—95387) **Development of an AI[artificial intelligence]-based optimization system for tandem mass spectrometry.** Wong, C.M.; Brand, H.R. (Lawrence Livermore National Lab., CA (USA)). Sep 1986. Contract W-7405-ENG-48. 54p. (CONF-8606239—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002376.

From Symposium on pattern recognition methods in analytical spectroscopy; Snowbird, UT, USA (16 Jun 1986).

The interfacing of the expert system to the triple quadrupole mass spectrometer (TQMS) proved the value of expertise, encoded in the form of rules, to complex optimization problems. The system is able to optimize the output of a complex instrument running chemical compounds in a way not practical with manual methods. Because the expert system approach allows the instrument to be tuned quickly, multiple mass range, or even individual mass pair tuning is now practical, resulting in large gains in instrument sensitivity. Two significant problems with the application of knowledge based systems to chemical instrumentation have been encountered. First, there is a significant learning curve associated with applying the technology, and second, the knowledge based systems software tools and the supporting hardware are expensive. While our experience has shown that the hardware and software tools are cost effective for developing the system, these high costs make fielding multiple copies of the expert system, using the total development environment, economically prohibitive. The alternative is to port the development system to other hardware using conventional languages, but this approach is practical only where the large costs of porting the software can be amortized over many systems. 8 refs., 16 figs.

9519 **Degenerate four-wave mixing as a spectrochemical analysis technique.** Ramsey, J.M.; Whitten, W.B. (Oak Ridge National Lab., TN). *Analytical Chemistry;* 59: No. 1, 167-171(1 Jan 1987).

The nonlinear spectroscopic technique of degenerate four-wave mixing (DFWM) is studied theoretically and experimentally for use as a spectrochemical analysis tool. Specifically, DFWM was evaluated for use in flame elemental analysis. The theoretical evaluation indicates that detection is fundamentally limited by Rayleigh scattering from flame gases. For the case of sodium this detection limit is estimated to be 0.01 pptr (part per trillion) or 10 fg/mL. A pulsed Nd:YAG pumped dye laser was used for the experimental study where aqueous solutions of sodium were aspirated into an air-C_2H_2 flame. A combination of spatial filtering, polarization selection, and time resolution is used to discriminate against background signals. A measured detection limit of 4 ppb sodium is obtained. Improved detection limits are expected for a continuous wave laser system.

9520 **Mass spectrometer interface for microbore and high flow rate capillary supercritical fluid chromatography with splitless injection.** Smith, R.D.; Udseth, H.R. (Pacific Northwest Lab., Richland, WA). *Analytical Chemistry;* **59**: No. 1, 13-22(1 Jan 1987). Contract AC06-76RL01830.

Improved methods for interfacing microbore and capillary supercritical fluid chromatography (SFC) with mass spectrometry, using a high flow rate interface with splitless injection, are described. The new interface incorporated a mechanically pumped expansion region behind the chemical ionization repeller electrode, allowing higher gas flow rates (100-200 mg of CO_2/min) than previous interfaces and providing an improvement over direct pumping of the ion source in terms of background contributions, ionization efficiency, and sensitivity. The effects of sample flow rate, restrictor geometry, and effluent heating were studied relevant to the transfer and detection of nonvolatile analytes. Separations are compared both microbore and capillary columns for a polarity test mixture, pesticides, and the nonionic surfactant Triton X-100 polymer using supercritical carbon dioxide and carbon dioxide modified with methanol. Microbore columns were shown to have greater limitations for pressure programming, and superior results were obtained with capillary columns.

9521 **Analytical supercritical fluid extraction of adsorbent materials.** Wright, B.W.; Wright, C.W.; Gale, R.W.; Smith, R.D. (Pacific Northwest Lab., Richland, WA). *Analytical Chemistry;* **59**: No. 1, 38-44(1 Jan 1987). Contract AC06-76RL01830.

The use of supercritical fluids for the analytical extraction of semivolatile and higher molecular weight materials from various adsorbent and particulate matrices was investigated. Instrumentation was designed to allow gram quantities of the matrix to be extracted at pressures up to 400 bar and temperatures to 235 °C with collection of the effluent in a sealed liquid-nitrogen-cooled flask. Carbon dioxide, isobutane, and methanol modified (20 mol %) carbon dioxide fluid systems were evaluated and compared to liquid Soxhlet extraction. Supercritical fluid extraction (SFE) provided very rapid (≈30 min) extraction with comparable efficiency to the Soxhlet methods, and both more rapid and more efficient extractions appear feasible. The more polar carbon dioxide-methanol fluid system gave higher extraction efficiencies for the more polar adsorbates and the isobutane system was more efficient for the higher molecular weight and less polar compounds.

9522 **Characterization of transition-metal molecular hydrogen complexes by solid-state proton NMR.** Zilm, K.W.; Merrill, R.A.; Kummer, M.W.; Kubas, G.J. (Yale Univ., New Haven, CT). *Journal of the American Chemical Society;* **108**: No. 24, 7837-7839(26 Nov 1986).

Recently it has been discovered that stable transition-metal complexes containing molecular hydrogen as a ligand can be prepared. Current research under way in several laboratories indicates that the eta^2 mode of binding hydrogen is fairly common and even occurs in several polyhydrides previously believed to be classical in structure. These molecules have been cited as examples of an arrested oxidative addition of hydrogen to a metal complex, and the observed variations in physical properties seems to indicate that the addition is halted at different points. Characterization of these eta^2-dihydrogen complexes has relied on solution NMR or single-crystal diffraction studies to verify that the H_2 ligand remains intact when bound. Interpretation of solution NMR results is complicated by the fluxional nature of these species, and location of the hydrogens by diffraction is hampered by anisotropic motion and disorder of the H_2 ligand. In this paper they report on a simple, generally applicable solid-state NMR method that is well suited for characterizing these species. The method uses the large dipolar couplings between the H_2 protons to determine their separation and does not require single crystals or deuteration of the other coordinating ligands.

9523 **Distance dependence of surface-enhanced resonance raman enhancement in Langmuir-Blodgett dye multilayers.** Cotton, T.M.; Uphaus, R.A.; Moebius, D. (Univ. of Nebraska, Lincoln). *Journal of Physical Chemistry;* **90**: No. 23, 6071-6073(6 Nov 1986). Contract FG02-84ER13261.

Monolayers of a surface-active dye incorporated into inert matrix material were transferred onto structurally defined silver island films by the Langmuir-Blodgett technique. The dye-containing monolayers were spaced from the surface by accurately known increments by deposition of inert spacer monolayers. Surface-enhanced resonance Raman spectra were observed from dye molecules spaced as distant as six spacer increments (ca. 16 nm) from the silver surface. These results indicate an electromagnetic mechanism is operative in this system in contradiction to a chemical mechanism which would require direct contact between the Raman-active species and the metal surface.

9524 **Species concentration measurements using coherent anti-Stokes Raman spectroscopy (CARS).** Farron, R.L. (Combustion Research Facility, Sandia National Labs., Livermore, CA 94550). pp 913 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

The determination of combustion species concentrations using coherent anti-Stokes Raman spectroscopy, (CARS) often demands accurate modeling of the relative intensities of resonant (rovibrational) and nonresonant (electronic) contributions to the CARS spectrum. The ratio of these intensities is nearly always used to infer concentrations, whether indirectly through analyzing its effect on spectral profiles, or directly through comparing resonant signals to externally or internally generated non-resonant signals. Concentration information is derived from the fact that resonant intensities relate directly to the abundances of individual species, while nonresonance intensities are a function of the total gas composition. To analyze CARS data, theoretical susceptibility spectra are calculated, convolved with appropriate instrument and/or laser lineshapes, and varied for best fit to experimental spectra.

9525 **Evaluation of ICP-AES for the analysis of Ga and GaAs.** Park, D.A.; Parsons, M.L. (Dept. of Chemistry, Arizona State Univ., Tempe, AZ 85287). pp 967 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

The determination of trace impurities in high purity Ga and GaAs has become increasingly important to the semiconductor industry. These impurities affect the semiconductor's electrical properties and can be detrimental to device performance. Previous methods for the analysis of these materials include Neutron Activation Analysis, Secondary Ion Mass Spectrometry, Spark Source Mass Spectrometry and Atomic Absorption Spectrometry. The viability of a rapid, multielemental technique for this ultra-trace analysis, ICP-AES, has now been investigated. The solid samples were dissolved in HCl and HNO/sub 3/ (3:1) and diluted with deionized water. The level of impurities in the high-purity solids are generally reported to be in the part per million to part per billion range. Normal dissolution of the sample for ICP analysis would dilute these contaminants even further. For this reason, a high solids nebulizer was utilized to accommodate solutions with up to ten percent dissolved solids. This kept the level of impurities within the quantitative working range of the ICP. The nebulizer used was an Applied Research Laboratories (ARL) Maximum Dissolved Solids Nebulizer (MDSN), a V-groove Babington-type nebulizer. An ARL 3510 ICP Spectrometer was utilized in this study. Impurity levels present in several Ga and GaAs samples are presented. Detection limits for several elements at this high level of dissolved solids were determined, including the other Group IIIA-VA elements, (Groups 13-15), and certain first row transition elements.

9526 **Array sensors and spectroscopy.** Hirschfeld, T. (Lawrence Livermore National Lab., P.O. Box 808, L-322, Livermore, CA 94550). pp 897 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—). Contract W-7405-ENG-48.

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

The triumphs of multiplex spectroscopy in the infrared, where FT-IR has swept all before it, are about to be repeated in the UV-VIS domain, based on the different technology of array detectors. The SNR gain of multiplexing, speed, and simultaneity, and the cost effectiveness of microelectronic technology, are driving the rapid and widespread acceptance of this technology. Encoding multiplexing systems, such as Fourier transform systems, have not become popular here because of cost and complexity factors and, increasingly, because of being on the wrong side of the bandwagon effect. However, several factors still need attention in order for array sensors to completely replace conventional seaming technology in the UV-VIS region. These factors are as follows: 1) Cost reduction. This is mainly a commercial problem controlled by the chicken-and-the-egg dilemma between cost reduction increasing market size and market increases driving down costs. However, this process can be greatly accelerated by adapting array instrumentation to standardized arrays, preferably some for which TV requirements have already created mass markets. 2) Sensitivity increases. On a per-channel basis, the typical diodes of arrays are not yet a match to PMTs, having higher quantum efficiency but also higher noises. The latter can be reduced by cooling, detector-size reduction (with low f/numbers and immersion to retain light-gathering power), low duty cycle amplification of accumulated signals, etc. But it is important to remember that higher Q/sub E/ and noise mean that diodes will always out-perform PMTs if the signal is large enough.

9527 Advances in energy transfer optrodes. Roe, J.; Hirschfeld, T.; Miller, H.; Burks, W. (Lawrence Livermore National Lab., P.O. Box 808, Livermore, CA 94550). pp 676 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—). Contract W-7405-ENG-48.

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

The absorption emission optrode, in which a colorimetric reagent turns a fluorescent transducer reagent on and off by radiationless energy transfer (quantum tunnelling), has shown itself to be a great advance in optrode design. Besides combining the more general availability of colorimetric reagent with the convenience of fluorescent measurement (more sensitivity, larger dynamic range, single ended, more stable in a fiber), they show an up to 1000X sensitivity enhancement due to the larger cross section of radiationless energy transfer over direct absorption of light. A number of new optrodes of this type have been developed. These include an NO/sub x/ sensor based on the use of a diazonium generating reagent that actually binds the fluorescent dye itself; a K/sup +/ (Na/sup +/) sensor based on the color changes of Takagi reagent (a crown ether picric acid derivative) in the presence of the ion, combined with a fluorescent sensing dye; and a polyethylene glycol sensor based on the variable extinction of membrane confined hexadecanoylacrinide micelles in the presence of Cu/sup ++/ in solution. The physics and optimization of this type of optrode are discussed.

9528 FT-IR with a twist. Hirschfeld, T. (Lawrence Livermore National Lab., P.O. Box 808, L-322, Livermore, CA 94550). pp 510 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—). Contract W-7405-ENG-48.

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

The well-known throughput or Jacquinot advantage of FT-IR has a minor image in one as yet unnamed advantage: if the throughput is made very low, the low aberrations of the Michelson interferometer allow the use of extremely small and very low noise detectors. Since, in absorption spectroscopy, the signal is the absorbed light and one can measure only its complement (the transmitted or reflected beam), it is to the authors advantage to go to the lowest possible throughput whenever they work with restricted samples. The authors can then drastically improve the overall measurement by throwing out most of the throughput.

9529 General indirect detection of non-electrolytes in liquid chromatography. Castrogivanni, M.A.; Banerjee, S. (Safety & Environmental Protection Div., Brookhaven National Lab., Upton, NY 11973). pp 376 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

The eluent in a reversed phase system is saturated with a lipophilic additive of low mobility in the system. The column is equilibrated with the amended eluent, and the detector is tuned to a property characteristic of the additive. Analytes are classified into two categories, those that are weakly retained relative to the additive, and those that are retained strongly. The former are unable to displace the additive from the column. However, these analytes may be able to increase the solubility of the additive in the eluent. This increase will result in a peak when the analyte elutes into the detector. An analyte which is strongly retained is able to competitively displace the additive from the stationary phase. The resulting vacancy for additive created on the stationary phase causes a negative signal when the analyte emerges from the column. A system signal corresponding to the retention time of the additive is also observed. Signals associated with weakly retained analytes are positive and precede the system signal. Those related to strongly retained analytes are negative and follow the system signal.

9530 Liquid and supercritical fluid chromatographic mobile phases as potential matrices in matrix-isolation infrared spectrometry. Boparai, A.S.; Ettinger, D.G.; Schneider, J.F. (Analytical Chemistry Lab., Argonne National Lab., 9700 South Cass Avenue, Argonne, IL 60439). pp 377 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—). Contract W-31-109-ENG-38.

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

Gas chromotography/matrix-isolation infrared spectrometry (GC/MIIR) is a technique for organic analysis developed at Argonne National Laboratory. Recently, a commercial instrument has become available to gas chromotography/mass spectrometry (GC/MS) with the added specificity of infrared spectroscopy. Several applications of GC/MIIR in the area of trace organic analysis have appeared in the current literature. In GC/MIIR, the GC effluent, mixed with a 1 to 2% argon, is condensed on a rotating gold-plated mirrored cylinder that has been cooled to 12 K. The separated components are deposited in a matrix of argon and are then analyzed by IR. Other techniques are needed for compounds that cannot be analyzed by GC, either because of low volatility or thermal instability. High performance liquid chromotography (HPLC) and supercritical fluid chromotography (SFC) are well suited for analysis of such compounds. To apply the cryogenic deposition method to SFC or HPLC, the properties of the solid matrices formed by the mobile phases must be known. Experiments have been performed to determine the effects of various mobile phases on the IR determinations of codeposited analytes. These results and the effects of temperature on the matrices are presented.

9531 Applications of GC/FTIR to environmental and degradation studies. Demirgian, J.C.; Stamoudis, V.C.; Stetter, J.R.; Brubaker, K.L.; Cole, R.L. pp 472 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

Gas chromatography/Fourier transform infrared spectroscopy (GC/FTIR) is used for the identification of components in complex organic mixtures and to complement confirmations made using only gas chromatography/mass spectroscopy (GC/MS). Two unique advantages of GC/FTIR and specific applications concerning analyses of complex organic mixtures are discussed, and the contributions of GC/FTIR to unambiguous identification of chemical species are presented.

9532 **An infrared detector (IRD) for gas chromatography.** Darland, E.J.; Mealer, L.D.; Michnowicz, J.A.; Tang, C.; Hirschfeld, T. (Hewlett-Packard Co., Scientific Instruments Div., 1601 California Avenue, Palo Alto, CA). pp 494 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

In this paper, the authors present an overview of a new Infrared Detector (IRD) for gas chromatography that makes routine, economical GC/IR analyses practical for the first time. The IRD hardware incorporates the first FT-IR spectrophotometer designed specifically for use as a routine GC detector. The rugged optical design is extremely compact, so that bench space in crowded laboratories is used very efficiently. Several aspects of the design result in a low-cost instrument with extremely good sensitivity, reproducibility, and linearity. The IRD has sufficient sensitivity to routinely detect and identify very low nanogram amounts of strong IR absorbers. The authors present data which indicate the performance to be expected with selected compounds from a variety of chemical classes (both strong and weak absorbers). The authors also describe new software which extends the powerful data acquisition and analysis environment of the Hewlett-Packard analytical workstations. The extended software provides the essential tools for acquiring, viewing and evaluating chromatographic and spectroscopic IR data, and contributes substantially to the ease with which the system can be used.

9533 **Uncommon problems for an uncommon technique: NIRA.** Hirschfeld, T.; Stark, E. (Lawrence Livermore National Lab., P.O. Box 808, L-322, Livermore, CA 94550). pp 87 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—). Contract W-7405-ENG-48.

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

During the past decade, near infrared spectrophotometric determinations have been applied to a large variety of mundane but necessary industrial and agricultural analyses. The use of modern chemometric techniques, with training samples for calibrations, and instrumentation with microabsorbance unit reproducibility have generated the analytical methodology known as NIRA. Despite the apparent spectroscopic difficulties of the near infrared, this technology results in a simple, fast, flexible, and widely applicable analytical tool. Both qualitative and quantitative analyses are performed by NIRA. Quantitative results are not restricted to merely chemical composition, but encompass the world of physical parameters such as crystallinity. The work reported here uses near infrared with correlation transform techniques (NIRA) for the analysis of materials which would be inconvenient, difficult or impossible to routinely assay by alternative techniques. The objective in each case was the development of an analytical method for routine application. The quantitation nitronium ion in concentrated solutions of nitric and sulphuric acid has been successfully accomplished with NIRA. Correlations depending on an electronic band and on H/sub 2/O were observed. The choice of analytical methods for degradation studies of high explosives is somewhat restricted. For example, raman spectroscopy is contraindicated due to the laser energy illuminating the sample. Photo degradation of trinitro-triamino benzene (TATB) and thermal degradation of penta erythrol tetranitrate (PETN) are studied using NIRA analysis.

9534 **Remote near infrared analysis.** Hirschfeld, T. (Lawrence Livermore National Lab., P.O. Box 808, L-322, Livermore, CA 94550). pp 88 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

Near infrared analysis using correlation transform spectroscopy has shown itself to be remarkably useful in general infrared analysis. In quantitative analysis, it can achieve reproducibilities and accuracies comparable to the best middle infrared spectrometer, does slightly better than they do in mixture analysis, and far outstrips them in convenience of sample preparation and measurement speed. A new potential for the technique now arises from its compatibility with current low cost fiber technology in the near IR, allowing remote measurements at ranges up to several hundred meters. These, which can be done at many locations in very close succession, give us all the benefits of on-line analysis at a fraction of the usual cost of the procedure. To achieve the necessary sensitivity, particularly with small-diameter low-cost optical fibers, requires many instrumentation improvements. Classical instrumentation, even with cavity enhanced blackbody sources, cooled small area germanium photodetectors, and low duty cycle noise suppressed preamplifiers, is somewhat marginal here. LED array based systems, although more expensive, have quite adequate signal levels, but limited (60% of the range) wavelength availability. Fourier transform instruments, using advanced sources and detectors, have good sensitivities, and their current high cost reflects a large and unnecessary excess of both throughput and resolution. Measurements on the two latter instrument types are described, as well as several applications.

9535 **Chromatography: Quo Vadis.** Hirschfeld, T. (Lawrence Livermore National Lab., P.O. Box 808, L-322, Livermore, CA 94550). pp 133 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—). Contract W-7405-ENG-48.

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

To forecast future advances in chromatography, one needs to look past immediate future improvements and incremental advances to the fundamental limits and capabilities of the technology. A number of long-term trends then become obvious. 1) Miniaturization. The continual reduction of column diameter in GC and LC will resume after its present difficulties with sampling and extra column broadening are overcome by the use of microlithography, and detector designers become aware of the current microscopy and microelectrode state of the art. 2) Convergent evolution. The conceptual unity of GC, LC SEC, and possibly electro-phoresis and flow injection assay as well, will spawn common hardware for all of these techniques as miniaturization renders their instrumental differences irrelevant. 3) Multidimensionality. The futility of accomplishing difficult separations by resolution alone (a linear gain) instead of by multidimensionality (on exponential gain) will become increasingly obvious. The progression from multiple columns to heartcutting, combinations of stop primary precolumns and fast secondary columns, and eventually true parallel multidimensionality will be inevitable, particularly in its easier application to condensed phase carrier streams. 4) Hyphenated systems. The ultimate goal of analysis is separation, identification, and quantitation. Hyphenated instruments, joining the power of another technique to that of chromatography, are essential to achieving the whole task. 5) Surface chromatography. Hitherto, all chromatography has been built around 3-dimensional diffusion phenomena in carrier streams and stationary phases. Nature has, however, accomplished exceptional performances in truly 2-D GC and LC, where diffusion occurs solely along atomic or molecular surfaces.

9536 **Antibody-based fiberoptic sensors: New tools for chemical and biological monitoring.** Vo-Dinh, T.; Griffin, G.D.; Ambrose, K.R.; Sepaniak, M.; Tromberg, B.J. (Health and Safety Research Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 19 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

Immunoassays are often applied to chemical and biological analyses of proteins, hormones, drugs, and viruses. These assays are characterized by the inherent selectivity of immunological reactions. Radioimmunoassays, which are currently the most widely utilized techniques, suffer from several disadvantages: potential confounding biological effects of the radiation, limited shelf life of radioisotopes, high cost of instruments and reagents, and special precautions for the shipping, handling, and waste disposal of radioactive materials. Alternative techniques, therefore, are being developed to avoid these limitations. This paper discusses the principle development, and applications of a new generation of fiberoptic sensors for detection of trace amounts of organic compounds and their metabolites in complex samples. This unique fluoroimmunosensor (FIS) derives its chemical selectivity from specific antibody-antigen reactions. Antibodies are immobilized at the terminus of a fiberoptic within the FIS, which can be used in both in-vitro and in-vivo fluorescence assays. High sensitivity is provided by laser excitation and optical detection using sensitive signal recovery techniques. Data illustrates the analytical capabilities and applications of the FIS to measure trace organic compounds in complex mixtures and within biological systems.

9537 **Double-resonance ionization mass spectrometry with high-resolution cw lasers.** Bushaw, B.A.; Cannon, B.D.; Gerke, G.K.; Whitaker, T.J. (Pacific Northwest Lab., Richland, WA 99352). pp 136 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Resonance ionization mass spectrometry (RIMS) is recognized as an extremely sensitive and selective method of atomic detection. The use of continuous lasers offers two distinct advantages over pulsed lasers for RIMS studies. The continuous duty cycle permits higher ion yields without space-charge effects and, therefore, often gives better sensitivity. In the authors' experiments, two counterpropagating single-frequency cw dye lasers are used to populate a highly excited state which is then ionized by the absorption of a photon from either a 100-W cw Nd:YAG or a 50-W CO/sub 2/ laser. The two-photon excitation to the Rydberg state is resonantly enhanced by tuning the first dye laser to (or near) one of the atomic resonance lines. Thus far, the authors have observed ionization efficiencies of a few tenths of a percent using short-lived upper states. In planned experiments, which should be completed by the time of this meeting, using high Rydberg states ($n \geqq 20$) and a cw CO/sub 2/ laser for ionization, the authors' expect efficiencies to approach unity due to the increased lifetime of the higher state and the increased IR photon flux.

9538 **Double-resonance techniques for high-resolution Raman spectroscopy.** Esherick, P.; Owyoung, A. (Sandia National Labs., Advanced Laser Technology Div., Box 5800, Albuquerque, NM 87185). pp 134 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

In an effort to improve on the sensitivity of coherent Raman spectroscopies the authors have been investigating double-resonance techniques that can combine the high resolution of stimulated Raman spectroscopy with the sensitivity of electronically resonant spectroscopies, such as multiphoton ionization. One such technique that has been highly successful is ionization detected stimulated Raman spectroscopy (IDSRS). In IDSRS resonant laser ionization is used to detect vibrationally excited molecules produced via stimulated Raman pumping. In a two-step process, molecules are first excited to $v = 1$ levels via a driven stimulated Raman transition. Following this the rotational/vibrational distribution is probed with resonant laser ionization by a tunable UV source. Raman spectra are obtained by scanning the frequency of one of the Raman pump sources and monitoring the ionization signal as a function of the frequency difference (Stokes shift) between this laser and the second fixed-frequency visible pump laser. By using two narrow-bandwidth pulsed lasers for the stimulated Raman step the authors are able to populate selectively discrete rovibrational levels, even for a molecule as large as benzene.

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REFER ALSO TO CITATION(S) 8821, 8823, 8824, 8828, 8844, 8853, 8854, 8901, 9393, 9605, 9616, 10011, 10031

9539 **(BDX—613-3625) High yield NMR, FY86-2: Quarterly report.** Smith, R.E. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Nov 1986. Contract AC04-76DP00613. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002959.

Several analytical methods were investigated this quarter. The previously developed method for determining the percent vinyl and phenyl in silicones has been modified, because it was discovered that the silicone gums are not perfectly homogeneous. Standards having a known vinyl and phenyl content were analyzed to confirm the accuracy of the NMR method. In addition, a high temperature carbon-13 NMR analysis of high strength, low density polymethylpentene (TPX) polymer was performed. A solder flux used on several programs was analyzed and the activator was identified as the hydrochloric acid (HCl) salt of glutamic acid. The reactions that occur in the model epoxy system, phenyl glycidyl ether plus dicyandiamide (DICY), plus boron trifluoride monoethylamine (BF_3-MEA) were investigated. The solvent carriers in two epoxies were identified. An alkaline cleaner was analyzed and a method was developed to estimate changes in detergent concentration. Methods based on carbon-13 NMR were developed to test the purity of organic compounds. 7 refs., 10 figs., 5 tabs.

9540 **(BNL—38802) Effect of high pressure on the excess electron mobility in nonpolar liquids.** Nishikawa, M.; Nakagawa, K.; Itoh, K.; Munoz, R.; Holroyd, R.A.; Fueki, K. (Brookhaven National Lab., Upton, NY (USA); Tokyo Univ. (Japan). Dept. of Pure and Applied Sciences; Nagoya Univ. (Japan). Dept. of Synthetic Chemistry). 1986. Contract AC02-76CH00016. 11p. (CONF-860980—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002154.

From 6. Tihany symposium on radiation chemistry; Lake Balaton, Hungary (21 Sep 1986).

Excess electron mobilities were measured in n-pentane, cyclopentane, n-hexane, 3-methylpentane, 2,2-dimethylbutane(DMB), 2,2,4-trimethylpentane(TMP) and tetramethylsilane(TMS) over the range 0.1 to 250 MPa and 20 to 120°C. For the first four liquids the mobility decreases with pressure at all temperatures studied. For 2,2-DMB and 2,2,4-TMP the mobility increases with increasing pressure at low temperatures but decreases with pressure at high temperatures. For TMS the mobility decreases with pressure only slightly at all temperatures. These results are compared with currently available theoretical models. 10 refs., 1 fig.

9541 **(DOE/ER/10612—17) Stable isotope studies: Annual progress report, November 1985-October 1986.** Ishida, T. (State Univ. of New York, Stony Brook (USA). Dept. of Chemistry). 1 Nov 1986. Contract AC02-80ER10612. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002453.

A new investigation on liquid ammonia and liquid ammonia solutions has been started. A molecular dynamics simulation study of liquid ammonia has been started for the primary purpose of obtaining a realistic intra- and inter-molecular forces for oscillating ammonia molecules. A simulation program has been written and an experimental N-N radial distribution function reproduced. The study of electric potential-assisted heterogeneous catalysis of hydrogen-isotope exchange between water and hydrogen has been continued. A systematic investigation of poisoning of platinum electrode by transition metal ions and sulfurous compounds and its depoisoning by the potential cycling have been carried out. Feasibility of using refractive index and vapor pressure measurements as a means for the hydrogen isotope analysis has been studied. The theoretical work on the additivity of the vibrational zero-point energy has been continued. The homologous series of branched paraffins, alkenes, dienes, and alkynes are being studied. The studies of H/D and ^{12}C/^{13}C vapor pressure isotope effects (VPIE) for liquid methylene difluoride and H/D and ^{14}N/^{15}N-VPIE for liquid and solid ammonia have been completed.

9542 (DOE/ER/12045—T1) **Thermophysical property measurements in fluid mixtures, Annual report.** Olien, N.A.; Levelt Sengers, J.M.H. (National Bureau of Standards, Boulder, CO (USA). Thermophysics Div.; National Bureau of Standards, Washington, DC (USA). Thermophysics Div.). Sep 1986. Contract AT01-82ER12045. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002076.

The objective of this program is the development of experimental methods for the measurement of equilibrium and transport properties of complex, multiphase fluids and fluid mixtures. The properties involved in the apparatus development are: PVT (pressure-volume-temperature), PVTx (pressure-volume-temperature-composition), phase equilibria (liquid-vapor and liquid-liquid equilibria), phase behavior at interfaces, and transport properties (viscosity, thermal conductivity, and diffusion coefficient). The apparatus are designed, where practical, for use in highly corrosive, toxic, and flammable fluids. The design goals for temperature and pressure are 800 K and 30 MPa (in some cases 70 MPa). It is not possible to meet these goals in all cases because of material requirements and limitations; for example, the need for visual cells for phase equilibria, the use of piezoelectric crystals for viscometry, and the temperature limitations of some pressure transducers. 8 refs.

9543 (DOE/ER/12088—12) **Photoelectrochemistry of new phenothiazine dye derivatives: Final report, 1 July 1982-30 June 1986.** Souto, F.A. (Center for Energy and Environment Research, Mayaguez (Puerto Rico)). 1986. Contract AS05-82ER12088. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003178.

The objective of this program is to assess the potential of functionalized redox dyes as simple models of more elaborated compounds that could mediate more efficiently direct conversion of photons into electrons with artificial photosynthetic systems. Experiments performed during the past year were designed to address the study of the electrochemistry involved in the sensitization of wide band-gap metal oxide semiconductors in colloidal suspension. The main oxides examined have been n-TiO_2, n-SnO_2, and n-ZnO. Derivatization of the colloidal surface with noble metals such as Pt and Au has been explored also. The properties of thionine and oxonine and its sulfonated analogues have been examined in the presence of the above colloidal semiconductor suspensions using absorption and emission spectroscopic techniques, fluorescence time decay in the picosecond time domain, flash photolysis in the microsecond time regime, rotating disk electrode, rotating optical disk ring electrode, and stopped flow electrochemical kinetics. The experiments performed have helped to establish the influence in the efficiency of sensitization of structural characteristics around the active chromophore. Electrostatic interaction between sensitizer and colloidal semiconductor particles has been found to play a fundamental role in sensitization. In addition, the utilization of the rotating optical disk ring electrode is found to have potential to advance current knowledge in this and related areas of research.

9544 (DOE/ER/13115—T2) **Energy transfer and reaction kinetics of vibrationally excited molecules. Final report.** Bergman, R.C.; DeLeon, R.L.; Rich, J.W.; Williams, M.J. (Calspan Advanced Technology Center, Buffalo, NY (USA). Physical Sciences Dept.). Sep 1986. Contract AC02-83ER13115. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87001639.

The present program is an experimental and analytical research study into energy transfer and reaction kinetics of vibration-to-vibration (V-V) pumped molecules. Extreme V-V pumped vibrational population distributions in CO, NO and other gaseous species are produced by optical excitation. Special emphasis is being placed on isotopic enrichment reactions of V-V pumped CO, which yield products enriched in ^{13}C, ^{17}O, and ^{18}O. Processes limiting vibrational up-pumping in CO and NO are being studied, especially vibration-to-electronic energy transfer from the pumped ground electronic state of these molecules to low lying excited electronic states. During the program, it has been demonstrated that V-V pumped CO can react to yield CO_2. The CO_2 thus formed is isotopically enriched in ^{13}C and ^{18}O. The enrichments obtained are significantly less than that predicted from measurements by the population distributions of the V-V pumped CO reactant. Possible causes of this discrepancy, and planned experiments to explore the causal mechanisms in detail, are discussed. 3 refs.

9545 (DOE/ER/72027—T1) **Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1985-November 30, 1986.** Madey, T.E. (National Bureau of Standards, Washington, DC (USA). Surface Science Div.). 1 Jul 1986. Contract AT01-77ER72027. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002998.

The areas of work supported under this contract by DOE during the period 12/1/85-11/30/86 have a common theme: the structure and reactivity of chemisorbed species and reaction intermediates of importance to catalysis. A variety of tools have been used to study the structure and chemistry of surface species, and to develop models and concepts of broad utility in chemisorption and catalysis. Fourteen papers have appeared, are in press, or in preparation in FY86. Results of the research conducted or completed in the last year are summarized in this report. The results are presented in three sections: surface molecular structure and reactivity as studied using electron stimulated desoprtion ion angular distribution (ESDIAD) and high resolution electron energy loss spectroscopy (HREELS); neutron inelastic scattering studies of adsorption and reaction on metal catalysts and zeolite catalysts; reaction kinetics at high pressures over single crystal metal catalysts: mechanisms of catalyst poisoning. A listing of publications during the past year is included.

9546 (DOE/FE/60339—T37) **The chemistry of carbonyl sulfide: Final report, July 1, 1985-February 28, 1986.** Dunkerton, L.V.; Tyrrell, J.; Sasa, M.; Combariza, J. (Southern Illinois Univ., Carbondale (USA). Dept. of Chemistry and Biochemistry). May 1986. Contract FC22-83FE60339. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002795.

Molecular orbital calculations using effective core potential (ECP) have been carried out on a variety of complexes of carbonyl sulfide (OCS) with transition metals (Pd and Pt). An initial scan of the potential energy surface (the geometry for the carbonyl sulfide molecule was held constant at its experimental values) was carried out in order to determine the most probable sites for the attack of the transition matal on the carbonyl sulfide molecule. Two sites were shown to be energetically favorable: the approach of the transition metal towards the oxygen atom along the internuclear axis and the approach of the transition metal above or below the C-S bond region. After optimization of these two structures, the second minima was shown to be energetically more stable than the linear arrangement. In this optimum structure, the carbonyl sulfide molecule is bent. The higher affinity of palladium and platinum towards sulfur is shown in the tendency of these transition metal to form eta^{2-}(OCS) type of bonds, in the order Pt > Pd. Dialkylaluminumchloride (R_2AlCl)-catalyzed ene reactions of carbonyl sulfide as an enophile with alkenes were performed. R_2AlCl selectively complexed to the thionyl sulfur of OCS, then reacted with different alkenes and formed corresponding alkenyl thioicacids as ene adducts. Those alkenes were limonene (1), β-pinene (2), and methylenecyclohexane (3). The reaction with 1 gave E and Z 3-[4 -(1′-hydroxy-1′ -methyl-cyclohexyl)]but-2-ene thiocacid (4) as a major product, which was formed from hydration of the thioicacid, a rearranged conjugated form of the original ene adduct. The reaction with 2 and 3 gave corresponding β,γ-unsaturated original thioicacids, 2-[2′-(6′,6′-dimethylbicyclo[3.1.1]hept-2′-ene)]ethane thioicacid (5) and 2-(1′ -cyclohexenyl)ethane thioicacid (6), respectively, as major products. 23 refs, 6 tabs.

9547 (DOE/FE/60339—T38) **Structure sensitive catalytic reactions over iron sulfides: Activation of hydrogen and carbon-hydrogen bonds: Final report, July 1, 1985-February 28, 1986.** Smith, G.V.; Phillips, J.B.; Nishizawa, Tsuneyuki. (Southern Illinois Univ., Carbondale (USA)). May 1986. Contract FC22-83FE60339. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002782.

Pyrite, the pyrrhotites, and troilite catalyze the oxidation of 1-pentanethiol to pentyl disulfide in the temperature range 373 to 523K in both H_2 and He. The reaction is catalytic over the iron sulfides and is influenced by the presence of traces of O_2. The iron sulfides may act as electron transfer catalysts. Additionally, troilite catalyzes the half-hydrogenation of 2-pentyne to cis- and trans-2-pentene with greater than 95% selectivity. 13 refs., 6 figs., 3 tabs.

9548 (DOE/FE/60339—T40) **Mixing of sulfur between pyritic and organic phases during coal conversion processes: Final report, July 1, 1985-February 28, 1986.** Dunkerton, L.V.; Smith, G.V.; Hinckley, C.C.; Phillips, J.B. (Southern Illinois Univ., Carbondale (USA)). May 1986. Contract FC22-83FE60339. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002784.

Derivatives of dibenzothiophene were prepared and characterized. The success of this work is due mainly to the established methodology of lithium reagants. The optimum conditions for maximum yield were worked out. The formation of lithiodibenzothiophenes was achieved by translithiation of the appropriate bromodibenzothiophene with n-butyl lithium. Most of the derivatives of dibenzothiophene are new, while some represent an improved preparation. Elaboration of more complex thiols and thioether functionalities was realized by the strategy of nucleophilic substitution reaction using previously reported reaction conditions. A new aspect of this study is that the ^{13}C-NMR chemical shift assignments of new substituted dibenzothiophenes are compiled here for the first time, and are useful in the characterization of new compounds. Standard organic sulfur compounds were mixed with iron sulfide and charcoal to provde a coal-like environment and the mixture was heated in the presence of hydrgen in a flow reactor. The flow reactor was coupled with a multiplex gas chromatography system for carrying out continuous, rapid analysis of the effluent stream from the reactor. The residue left behind was analyzed using Moessbauer spectroscopy and mass spectroscopy. Sulfur migrated from the organic phase to the inorganic phase (troilite) during the hydrodesulfurization reactions. However, the sulfur in the dibenzothiophene ring is very stable and is not removed under the present reaction conditions. The presence of iron silfide (troilite) enhances hydrodesulfurization. 21 refs., 12 figs., 2 tabs.

9549 (DOE/PC/80521—T5) **[Acid base properties of coals and other solids: Quarterly no. 4, 09/01/86-11/30/86].** (Duke Univ., Durham, NC (USA)). 24 Nov 1986. Contract FG22-85PC80521. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002679.

A variety of thermodynamic techniques have been used in this laboratory to compare the overall interactions of a variety of bases with several types of coals and solid acids, including sulfonic acid resins, silica gel, carbonaceous solids, such as graphite and Ambersorb. Specifically, it has been demonstrated that Dowex 50-W resin is a good model for heterogeneous Broensted acidity and that silica gel is a good model for hydrogen-bonding acidity. Various coals: Wyoming Rawhide, Illinois #6, Texas Lignite and Anthracite differentiated by our thermochemical method are classified by multiparameter expressions using Dowex, silica and graphite as model solids. This investigation of solid acidity has progressed to the point where a study of solid Lewis acidity seems appropriate. Alumina has been chosen for evaluation as a model Lewis acid solid. Presented in this report are results from a thermodynamic study of aluminum hydroxide; commonly referred to as alumina. Two aluminas, delta-theta and kappa, were used to perform heat of immersion studies. Also described are initial results from a flow calorimetric-ultraviolet spectroscopic study of aluminas; this technique allows one to determine the amount of adsorbent which contributes to the heat of adsorption so that results can be expressed in kcal/mol. 10 refs., 4 figs., 2 tabs.

9550 (JAERI-M—85-098) **Effect of operation conditions on ammonia evolution in isothermal composting of sewage sludge.** Nishimura, Koichi; Watanabe, Hiromasa; Hashimoto, Shoji; Kawakami, Waichiro. (Japan Atomic Energy Research Inst., Tokyo; Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). Jul 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700259.

In the isothermal composting of sewage sludge, influences of operation conditions on NH_3 evolution were studied to obtain information on the sludge deodorization during composting. The pattern of CO_2 evolution from the sludge was not affected by the aeration rate or the bulking agent. On the other hand, the pattern of NH_3 evolution was affected by the fermentation condition and the overall weight ratios of C in CO_2 to N in NH_3, CO_2-C/NH_3-N in the total gas evolved varied with fermentation time. The ratios approached to almost constant values ranging from 5 to 7 in earlier stages at higher aeration rate or temperature. These facts mean that the change of NH_3 evolution pattern with fermentation conditions is due to NH_3 absorption by the sludge and the bulking agent, and actually, the NH_3 generation is a simultaneous process with CO_2 generation. Therefore, deodorization by composting can be completed at the end of fermentation.

9551 (Juel-Spez—316, pp 98-101) **Alignment of anisotropic micelles and their relaxation behaviour.** Herbst, L.; Hoffmann, H.; Kalus, J.; Schmelzer, U.; Thurn, H. (Bayreuth Univ., Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article presents experiments on liquids which show the phenomenon of viscoelasticity. The measurements shall give informations on the microscopic interaction of the responsible micelles. (BHO).

9552 (K/PS—923) **Preparation and characterization of tripotassium fluonickel(IV)ate.** Rapp, K.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Oct 1984. Contract AC05-84OT21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002802.

A complex fluoride combining potassium and nickel in the exact ratio of 3 to 1 has been prepared by an exhaustive fluorination of dehydrated pellets made from an air dried reaction mixture of KF x $2H_2O$ and $NiCl_2$ x $6H_2O$. Although both salts were reagent grade, the proper intermetallic composition was attained only through the aid of precision analysis. When the pellet bed was exposed to fluorine in a temperature range of 400°C, the chloride content was originally volatilized as ClF, ClO_2F, and ClO_3F. Not until the fluorine exposure temperature was raised to 515°C were the last traces of chlorine expelled as ClF_3. A pellet bed so prepared becomes a thermally reversible, selective sorbent for fluorine at 225°C which is potentially very useful for recovery of fluorine at low concentrations or pressures subsequently making the purified gas available at 400°C at a vastly enhanced pressure for gas phase reaction. Although chemisorption of fluorine by the complex to form K_2NiF_6 x KF is virtually quantitative at the lower end of the reversing temperature range, there is very little tendency for other fluorinating gases such as UF_6 or ClF_3 to be sorbed, however, overnight exposure of the sorbent to ClF_3 results in a significant abstraction of fluorine producing ClF as the residual gas. 5 refs., 1 fig.

9553 (LBL—21772) **Modifications of the surface properties of metals by oxide overlayers: 1, Oxidized zirconium deposited on the Pt(100) single crystal surface.** Bardi, U.; Ross, P.N. (Lawrence Berkeley Lab., CA (USA); Florence Univ. (Italy). Dipartimento di Chimica). Jun 1986. Contract AC03-76SF00098. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003640.

Metallic zirconium was deposited on a single crystal Pt(100) surface by thermal evaporation in UHV conditions. The deposit was oxidized by exposure to oxygen immediately after deposition.

Oxidized zirconium was found to grow on the platinum ace by the layer-by-layer mechanism. The adsorption of carbon monoxide on the surface was studied as a function of the zirconium coverage. The results show that oxidized zirconium forms a chemically inert layer which blocks the adsorptive sites of the underlying platinum substrate. The properties of the free Pt surface were unaffected by the presence of the oxidized zirconium layer.

9554 (LBL—21773) Modifications of the surface properties of metals by oxide overlayers: 2, Pt deposited on a preoxidized Zr(0001) surface. Bardi, U.; Ross, P.N. (Lawrence Berkeley Lab., CA (USA); Florence Univ. (Italy). Dipartimento di Chimica). Jun 1986. Contract AC03-76SF00098. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003641.

Platinum was deposited by means of thermal evaporation in UHV conditions on a (0001) oriented zirconium single crystal surface. Before deposition, the zirconium substrate was superficially oxidized by exposure to oxygen at room temperature. The AES growth curves recorded at room temperature indicate that the platinum growth mechanism is Volmer-Weber type (3D clusters). Upon annealing, we observed by AES a reduction of the oxygen content of the surface and the concomitant interdiffusion of Pt and Zr. The angular dependence of the Pt/Zr AES ratio and the shape of the CO thermal desorption peak suggest that annealing causes the formation of a Pt/Zr binary surface compound.

9555 (LBL—22196) Catalytic gasification of chars and carbon: Annual report, October 1, 1985-September 30, 1986. Heinemann, H. (Lawrence Berkeley Lab., CA (USA)). Sep 1986. Contract AC03-76SF00098. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003625.

This program is designed to study the basic chemistry of the reaction of carbonaceous materials with water in the presence of catalysts to produce hydrocarbons and/or synthesis gas. Relatively low temperatures are being used. Earlier work has shown that a combination of KOH and a transition metal oxide, such as NiO, constitutes catalysts superior to either component alone. It is an objective of the present task to identify the optimum ratio of the components and to determine the existence and composition of a potential catalytic compound, e.g., a potassium nickelate. The applicability of the reactions thus far studied with graphite to char, coke and possibly coal will be investigated. Improvements in kinetics will be sought and the effect of added gases, such as H_2S, CO and O_2 will be researched. 9 refs., 12 figs., 1 tab.

9556 (MLM—3406(OP)) Tritium recovery by cryogenic hydrogen isotope distillation. Embury, M.C.; Kent, L.R.; Erwin, M.G. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1986. Contract AC04-76DP00053. 7p. (CONF-861146—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003020.

From AIChE winter annual meeting; Miami, FL, USA (2 Nov 1986).

The Hydrogen Isotope Separation System (HISS) recovers radioactive tritium (H^3) from mixtures of hydrogen isotopes using cryogenic distillation. HISS receives feeds containing six molecular species of hydrogen and enriches the tritium to greater than 90% with a single raffinate containing less than 0.5 Ci/day. Test results with protium-deuterium mixtures are presented.

9557 (N—86-33128) Theoretical dissociation energies for ionic molecules. Langhoff, S.R.; Bauschlicher, C.W. Jr.; Partridge, H. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). 1986. 64p. (NASA-TM—88776; NAS—1.15:88776). NTIS HC A04/MF A01.

Ab initio calculations at the self-consistent-field and singles plus doubles configuration-interaction level are used to determine accurate spectroscopic parameters for most of the alkali and alkaline-earth fluorides, chlorides, oxides, sulfides, hydroxides, and isocyanides. Numerical Hartree-Fock (NHF) calculations are performed on selected systems to ensure that the extended Slater basis sets employed for the diatomic systems are near the Hartree-Fock limit. Extended Gaussian basis sets of at least triple-zeta plus double polarization equality are employed for the triatomic system. With this model, correlation effects are relatively small, but invariably increase the theoretical dissociation energies. The importance of correlating the electrons on both the anion and the metal is discussed. The theoretical dissociation energies are critically compared with the literature to rule out disparate experimental values. Theoretical (sup 2)Pi - (sup 2)Sigma (sup +) energy separations are presented for the alkali oxides and sulfides.

9558 (SAND—86-1966C) Emission spectra of polysilanes. Harrah, L.A.; Zeigler, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 27p. (CONF-860911—21). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002492.

From 192. American Chemical Society national meeting; Anaheim, CA, USA (7 Sep 1986).

We have examined the emission spectra of a variety of polysilanes as thin films and solutions. The solution fluorescence thermochromism provides evidence to support the rotational isomeric state model used to interpret the absorption spectrum. The structured character and low yield of phosphorescence in the alkyl polysilanes suggest that the triplet is the immediate precursor to photochemical scission. The change in character of both fluorescence and phosphorescence on going from phenyl to naphthyl in the aryl series indicates that the transitions in the naphthyl polymers are principally π-π. 31 refs., 10 figs., 2 tabs.

9559 (SAND—86-2426C) Studies of the interaction of CO with the interface states for strained-layer Cu on Ru(0001). Houston, J.E.; Peden, C.H.F.; Feibelman, P.J.; Hamann, D.R. (Sandia National Labs., Albuquerque, NM (USA); Bell Labs., Murray Hill, NJ (USA)). 1986. Contract AC04-76DP00789. 5p. (CONF-861019—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002477.

From 10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society; Baltimore, MD, USA (27 Oct 1986).

Bimetallic surfaces are important in commercial catalytic applications because they afford the possibility of tailoring catalytic selectivity and activity. They are interesting scientifically because such systems can be studied under very carefully controlled conditions offering the promise of understanding the relationship between structural and electronic properties and the resulting chemical behavior. In recent studies, Cu has been shown to grow in 2d islands psuedo morphic to the Ru(0001) surface under a tensile strain of about 6% with respect to the Cu bulk lattice constant. The chemical behavior of such films is unlike that of either of the pure elements both from the standpoint of the adsorption properties for molecular species and in regard to the reactivity with respect to certain surface chemical reactions. In addition, these strained-layer films show evidence for unique electronic properties, specifically a set of interface and surface states near the anti K point in the surface Brillioun zone (SBZ). This identification was made on the basis of Angular-Resolved Photoemission (ARUPS) and Linearized Augmented Plane Wave (LAPW) calculations. Here, we describe the results of further studies of the behavior of these interface and surface states with respect to the adsorption of CO. 7 refs., 1 fig.

9560 (UCRL—53770) Long-term solvent loss from solutions stored in closed containers. Lindner, M. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003285.

Long-term gradual solvent losses from closed containers have been measured. The losses were due to evaporation, and they occurred from glass vessels closed with polyethylene screw caps and from similarly closed polyethylene bottles and tubes. The evaporative losses from the glass vessels varied from negligible to important for long-term storage of solutions. For the polyethylene vessels, evaporation rates were even more serious. The measurements were made with a single-pan analytical balance which showed long-term environmental weight variations that could have easily exceeded the evaporation effect. These variations were satisfactorily eliminated by simultaneously monitoring the weights of tare objects of the same dimensions as those being weighed. It was found that variations in moisture adsorption on the glass surfaces could not explain long-term variations in the weights of the tare vessels. 1 ref., 5 figs., 1 tab.

9561 Neutron profile refinement of the structure of FeOCl and FeOCl(TTF)/sub 1/8.5/. Kauzlarich, S.M.; Stanton, J.L.; Faber, J. Jr.; Averill, B.A. (Univ. of Virginia, Charlottesville). *Journal of the American Chemical Society;* **108**: No. 25, 7946-7951(10 Dec 1986). Contract W-31-109-ENG-38.

Neutron diffraction studies on powder samples of FeOCl and FeOCl(TTF)/sub 1/8.5/ establish that TTF intercalated into FeOCl contributes to the diffraction pattern and exhibits long-range order. Room-temperature time-of-flight diffraction results are reported. The structure of FeOCl was refined in a space group Pmnm with a = 3.7730 (1) A, b = 7.9096 (1) A, and c = 3.3010 (1) A. Least-squares Rietveld refinement (21 parameters, 3296 degrees of freedom) yielded R = 0.0169, R/sub w/ = 0.0248 (R/sub expected/ = 0.0115). The structure of FeOCl(TTF)/sub 1/8.5/ was refined in space group Immm with a = 3.784 (2) A, b = 3.341 (2) A, and c = 25.97 (2) A, using a model in which the TTF molecules lie in the bc plane, with equal occupancy of the four possible sites, to give R = 0.0203, R/sub w/ = 0.0289, and R/sub expected/ = 0.0111 (28 parameters, 1894 degrees of freedom).

9562 Reaction of group 4 metal eta^2-acyls with pyridine: formation of α,α-disubstituted-2,6-pyridinedimethoxide ligands. Fanwick, P.E.; Kobriger, L.M.; McMullen, A.K.; Rothwell, I.P. (Purdue Univ., West Lafayette, IN). *Journal of the American Chemical Society;* **108**: No. 25, 8095-8097(10 Dec 1986). Contract FG22-85PC80909.

Over the last 10 years the early-transition-metal, lanthanide, and actinide eta^2-acyl functional group has received considerably study by both synthetic and theoretical chemists. This has been prompted by the unique reactivity of these groups compared to their more well-studied, later-transition-metal analogues. They wish to report here the observed insertion of group 4 metal eta^2-acyls into the ortho-CH bonds of pyridine ligands. This result not only demonstrates a novel reactivity for the functionality but also represents a high-yield synthetic route to α,α-disubstituted-2,6-pyridinedimethoxide ligands; ligands that have received recent attention by a number of research groups.

9563 Oxygenated cytochrome P-450-CAM and chloroperoxidase: direct evidence for sulfur donor ligation trans to dioxygen and structural characterization using EXAFS spectroscopy. Dawson, J.H.; Kau, L.S.; Penner-Hahn, J.E.; Sono, M.; Eble, K.S.; Bruce, G.S.; Hager, L.P.; Hodgson, K.O. (Univ. of South Carolina, Columbia). *Journal of the American Chemical Society;* **108**: No. 25, 8114-8116(10 Dec 1986).

Two heme iron enzymes, oxygenated chloroperoxidase and cytochrome P-450-CAM, have been characterized using extended X-ray absorption fine structure spectroscopy (EXAFS). The EXAFS spectra of the two compounds are identical within the spectral noise. Curve filling has lead to the conclusion that both enzymes have an axial sulfur donor atom. Comparison of typical bond lengths leads to the conclusion that the bonding sulfur atom is a thiolate.

9564 Differential anomalous X-ray scattering evidence for the existence of μ-$H_3O_2^-$ bridging ligands in solution. Lorentz, R.D.; Bino, A.; Penner-Hahn, J.E. (Stanford Univ., CA). *Journal of the American Chemical Society;* **108**: No. 25, 8116-8117(10 Dec 1986).

Differential anomalous X-ray scattering has been used to confirm the existence of μ-$H_3O_2^-$ bridging ligands in aqueous solutions. Dimers and higher polymers of the trinuclear cluster $[M_3O_2(O_2CR)(H_2O)_3]^{2+}$ (M = W, Mo; R = CH_3, C_2H_5) exhibit partial deprotonation of the water ligands leading to $H_3O_2^-$ bridges between M_3 clusters. EXAFS data did not distinguish monomers from polymers.

9565 Thermochemistry of solvation of SF_6p by simple polar organic molecules in the vapor phase. Sieck, L.W. (National Bureau of Standards, Gaithersburg, MD). *Journal of Physical Chemistry;* **90**: No. 25, 6684-6687(4 Dec 1986).

The stabilities of SF_6^-HR association ions, where HR is a simple aliphatic alcohol, H_2O, or $(Me)_2SO$, have been investigated by the technique of pulsed-electron-beam high-pressure mass spectrometry. Equilibrium constants were determined as a function of temperature in order to define ΔH^0 and ΔS^0 values for solvation. The binding energies are quite low, ranging from 10.5 kcal mol^{-1} for $SF_6^-H^3O$ to 14.7 kcal mol^{-1} for $SF_6^-Me_2SO$. For ligands in which the nature of the bonding is expected to be similar, the binding energies increase nonlinearly with increasing acid strength of ligand. On the basis of additional measurements involving I^- HR complexes, as well as existing literature values, the binding energies in SF_6^- HR ions are found to be slightly higher than those for I^-HR. The SF_6^- HR complexes are less stable, however, due to their more positive dissociation entropies. Some comments are also included concerning the SF_2^- SF_6 dimer ion.

9566 Relative acidities of water and methanol and the stabilities of the dimer anions. Meot-Ner, M.; Sieck, L.W. (National Bureau of Standards, Gaithersburg, MD). *Journal of Physical Chemistry;* **90**: No. 25, 6687-6690(4 Dec 1986).

The difference between ΔH^0/sub acid/ of H_2O and CH_3OH was directly measured to be 9.6 +/- 0.2 kcal/mol at 600 K by variable-temperature pulsed high-pressure mass spectrometry. This result defines ΔH^0/sub acid/(CH_3OH) at 300 K as 381.6 +/- 0.7 kcal/mol and also confirms published values of EA(CH_3O) and ΔH^0/sub D/(CH_3O-H). H_2O was also used a reference to measure ΔH^0/sub acid/(C_6H_6) as 400.7 +/- 0.8 kcal/mol at 600 K. The dissociation energies of the hydrogen-bonded dimers OH^- H_2O (26.8 kcal/mol), CH_3O^- H_2O (23.9 kcal/mol), and CH_3O^- CH_3OH (28.8 kcal/mol) were also measured. The former two are found to be in very good agreement with published ab initio results.

9567 Glass transition and viscosity of P_2O_5. Martin, S.W.; Angell, C.A. (Purdue Univ., West Lafayette, IN). *Journal of Physical Chemistry;* **90**: No. 25, 6736-6740(4 Dec 1986).

The calorimetric glass transition temperature T/sub g/ for pure anhydrous P_2O_5 melted in sealed SiO_2 ampules at 1000 °C has been obtained directly for the first time with differential scanning calorimetry, and the increase in heat capacity at T/sub g/ has been determined. T/sub g/ measured in this way is 57 K higher than the value quoted in the literature, which is probably based on an Arrhenius law extrapolation of viscosity data to eta = 10^{13} P. Combining the high-temperature viscosity data with the common observation that, for oxide glasses, eta = 10^{12} P at the DSC T/sub g/, the authors find that the P_2O_5 viscosity obeys an Arrhenius law over at least 6 decades of eta. Furthermore, the intercept at 1/T = 0 coincides with the common point of T/sub g/ - reduced viscosity plots for a wide variety of liquids recently used in establishing the strong vs. fragile classification of glass-forming liquids. On this basis, P_2O_5 behaves as the archetypal strong liquid. However, the value of C/sub p/(liquid)/C/sub p/(glass) at T/sub g/, 1.27, is larger than expected on this basis since other strong liquids show smaller values, e.g., GeO_2 (1.09) and BeF_2 (no ΔC/sub p/ detected). The dependence of T/sub g/ on heating rate has been determined and shows that enthalpy relaxation in the transition region has, within error, the same activation energy (43.9 kcal/mol) as for viscous flow.

9568 NMR studies of clustering in solids. Baum, J.; Pines, A. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **108**: No. 24, 7447-7454(26 Nov 1986). Contract AC03-76SF00098.

The authors present a time-resolved multiple-quantum NMR experiment which allows us to determine the spatial distribution of atoms in materials lacking long-range order; in particular, they study the size and extent of atomic clustering in these materials. Multiple-quantum NMR is sensitive to the distribution of spins in a solid. At the two extremes, uniformly distributed spins absorb radio-frequency quanta continuously, whereas clustered groups of N spins can absorb only up to N quanta. Model experiments are demonstrated on the hydrogen distribution in selectively deuterated organic solids and in hydrogenated amorphous silicon.

9569 **Ionic hydrogen bond and ion solvation. 5. OH...O^- bonds. Gas-phase solvation and clustering of alkoxide and carboxylate anions.** Mautner, M.M.N.; Sieck, L.W. (National Bureau of Standards, Gaithersburg, MD). *Journal of the American Chemical Society;* **108**: No. 24, 7525-7529(26 Nov 1986).

Dissociation energies, ΔH°/sub D/, of RO^- x HOR, $RCOO^-$ x HOR, and $RCOO^-$ x HOOCR complexes range from 14 to 29 kcal/mol. Large values of ΔH°/sub D/ are observed for the symmetric dimers CH_3O^- x $HOCH_3$ (28.8 kcal/mol) and CH_3COO^- x $HOOCCH_3$ (29.3 kcal/mol). ΔH°/sub D/ decreases as the difference between the acidities of the components increase; e.g., for dimers with large $\Delta\Delta H^{\circ}$/sub acid/ such as CH_3COO^- x H_2O and $HCOO^-$ x H_2O ($\Delta\Delta H^{\circ}$/sub acid/ = 42.2 and 45.5 kcal/mol, respectively), ΔH°/sub D/ = 16.0 kcal/mol. For 13 dimers, a linear correlation of the form ΔH°/sub D/ = 28.4 - 0.29 $\Delta\Delta H^{\circ}$/sub acid/ is obtained. Some dimers deviate substantially from the correlation, suggesting special structural effects. For example, the large value of ΔH°/sub D/ = 36.8 kcal/mol for $HCOO^-$ x HOOCH suggests double hydrogen bonding, involving a CH...O^- type bond. On the other hand, the data suggest that only one hydrogen bond is formed in $RCOO^-$ x H_2O. Comparison between anionic and cationic hydrogen bonded systems shows that the bonding energies are similar for RO^- x B and ROH_2^+ x B complexes involving the same ligand B, suggesting primarily electrostatic interactions in both, while $RCOO^-$ x B is weaker by 4-6 kcal/mol than $RCOOH_2^+$ x B, probably due to charge delocalization in $RCOO^-$.

9570 **Unusually facile dissociation of benzene by ruthenium metal.** Polta, J.A.; Thiel, P.A. (Iowa State Univ., Ames). *Journal of the American Chemical Society;* **108**: No. 24, 7560-7567(26 Nov 1986). Contract W-7405-ENG-82.

Associative chemisorption of benzene at room temperature has been reported on several group VIII metal surfaces (Ni, Rh, Pd, Pt), where molecular adsorption is followed by partial dissociation and partial desorption at higher temperatures. However, they find that between one-fourth and one-half of a full layer of benzene adsorbs irreversibly at 85 K into a state which represents either a dissociated form of benzene or a molecular precursor to dissociation. Those molecules which subsequently adsorb do not dissociate and can desorb in several states between 120 and 180 K. For these, the chemisorption bond is very weak, only 9-11 kcal/mol. They propose that this is true because the Ru surface is electronically or sterically modified by the dissociative phase. Coadsorbed water can prevent decomposition but cannot displace benzene from the dissociative phase. Furthermore, the adsorbed benzene surface layer acts as a template for growth of a metastable benzene multilayer, which has a heat of sublimation of 7 +/- 1.4 kcal/mol. The metastable multilayer is eventually converted completely to normal bulk benzene at very high coverages. The data are obtained from several types of experiments: multiple-mass thermal desorption spectroscopy of benzene itself, quantitative oxidation of residual carbon, and competitive coadsorption of benzene and water.

9571 **Theoretical studies of diphosphene and diphosphinylidene in their closed-shell states, low-lying open-shell singlet and triplet states, and transition states. Search for a stable bridged structure.** Allen, T.L.; Scheiner, A.C.; Yamaguchi, Y.; Schaefer, H.F. III. (Univ. of California, Davis). *Journal of the American Chemical Society;* **108**: No. 24, 7579-7588(26 Nov 1986). Contract AC03-76SF00098.

The authors have undertaken a systematic study of the various low-lying electronic states of the H_2P_2 system, about which little is known experimentally, using the methods of ab initio molecular electronic structure theory. For each state they have predicted its molecular geometry, energy, dipole moment, vibrational frequencies, and their associated normal modes. The ground state is trans-HP=PH, 3.5 kcal/mol below cis-HP=PH. The $H_2P{=}P$ isomer lies at a relative energy of 28 kcal/mol above the ground state. For the ground state the highest occupied molecular orbital (HOMO) is n/sub +/, a symmetric lone-pair combination; the second HOMO is the P-P π bond. In $H_2P{=}P$ a lone pair n/sub y/ is the HOMO, and the P-P π bond is the second HOMO. For both isomers the lowest unoccupied molecular orbital (LUMO) is the antibonding P-P π^* orbital. A variety of states involving n-π^* and π-π^* excitations have been studied for various molecular geometries. The lowest energy open-shell singlet is a pyramidal H_2PP $^1A''$ state (out-of-plane angle 77°) at a relative energy of 46 kcal/mol. A skewed HPPH ^1B state (torsion angle 109°) is at 64 kcal/mol. Highly distorted geometries are also characteristic of the triplet states. A pyramidal H_2PP $^3A''$ state (out-of-plane angle 79°) has a relative energy of only 21 kcal/mol, and thus it is predicted to lie below the closed-shell planar H_2PP state. A skewed HPPH ^3B state (torsion angle 90°) is at 29 kcal/mol. An unsuccessful search has been made for a stable doubly bridged PH_2P structure, analogous to SiH_2Si.

9572 **Regioselective phosphoranylation and cyclodehydration of triols with diethoxytriphenylphosphorane.** Kelly, J.W.; Evans, S.A. Jr. (Univ. of North Carolina, Chapel Hill). *Journal of the American Chemical Society;* **108**: No. 24, 7681-7685(26 Nov 1986).

Diethoxytriphenylphosphorane (DTPP) selectively diphosphoranylates the vicinal diol functional group in 1,2,4-triols affording thermodynamically stable 2,2,2-triphenyl-1,3,2-dioxaphospholanes. When subjected to thermolysis conditions, these dioxaphospholanes dissociate to form transient betaines which subsequently collapse, via 3-exo-tet extrusion of triphenylphosphine oxide, to epoxides. The structures of the 2,2,2-triphenyl-1,3,2-dioxaphospholanes are readily assessed from /sup n/J/sub ^{31}P-^{13}C/ (n = 2,3) coupling constants and ^{31}P chemical shifts. Alkyl and aryl substituents attached to the dioxaphospholane ring also induce pronounced substituent shielding effects on the ^{31}P resonance of the phospholanes. These effects are useful in corroborating the structural assignments of the dioxyphosphoranes.

9573 **Enhancement of free-radical chain rearrangement, cyclization, and hydrogenolysis during thermolysis of surface-immobilized bibenzyl: implications for coal chemistry.** Buchanan, A.C. III; Dunstan, T.D.J.; Douglas, E.C.; Poutsma, M.L. (Oak Ridge National Lab., TN). *Journal of the American Chemical Society;* **108**: No. 24, 7703-7715(26 Nov 1986). Contract AC05-84OR21400.

Condensation of p-$HOC_6H_4CH_2CH_2C_6H_5$ (15c) with the surface hydroxyls of fumed silica gave a surface-immobilized form of bibenzyl (16c) whose thermolysis was compared with that studied earlier for liquid and gaseous bibenzyl (1). The objective was to explore the effects of restricted mobility on a multipathway free-radical reaction, with particular emphasis on modeling dimethylene linking units between aromatic clusters in coal. The initial rate of thermolysis of 16c at 350-400°C was accelerated some fourfold compared with 1, and the product composition was notably altered. The major initial product classes in order of decreasing amounts, were the following: (1) rearrangement to form surface-attached 1,1-diphenylethane (18); (2) cyclization-dehydrogenation to form surface-attached 9,10-dihydrophenanthrene (20) (and subsequently surface-attached phenanthrene (21)); (3) symmetrical cleavage to form both surface-attached and gas-phase toluene (19 and 3) in similar amounts; (4) dehydrogenation to form surface-attached stilbene (24); and (5) unsymmetrical hydrogenolysis to form surface-attached ethylbenzene (22) plus gas-phase benzene (10) and the analogous pair, 23 plus 11, in similar amounts. For liquid 1, cyclization and unsymmetrical cleavage had been barely detectable and rearrangement was only a minor pathway. The rate constant for unimolecular C-C homolysis in 16c, based on 3 and 19, was 10/sup 15.3/ exp(-62,900/RT) s^{-1}, not significantly different from that of 1 and not dependent on surface coverage. However, the initial extent of rearrangement, expressed as a chain length, was accelerated some 30-fold compared with that of liquid 1; cyclization and unsymmetrical cleavage were similarly enhanced.

9574 **Hydrodesulfurization of organosulfur heterocycles by metal hydride-nickel(0) complexes: accelerated single-electron transfer in carbon-sulfur bond cleavage.** Eisch, J.J.; Hallenbeck, L.E.; Han, K.I. (State Univ. of New York, Binghamton). *Journal of the American Chemical Society;* **108**: No. 24, 7763-7767(26 Nov 1986). Contract FG22-81PC40782;FG22-84PC70786.

The novel nickel complex, $LiAlH_3(THF)$/sub n/ x $C_{10}H_8N_2$ x Ni (2), which results from the interaction in a THF solution of (2,2′-bipyridyl)(1,5-cyclooctadiene)nickel (1) with $LiAlH_4$ in a 1:1

molar ratio is a powerful desulfurizing agent in homogeneous solution for such aromatic sulfur hetercycles as dibenzothiophene (3), phenoxathiin (11), phenothiazine (12), and thianthrene (13). When employed in a 2:1 molar ratio with the heterocyclic substrate, 2 produces the corresponding ring-opened desulfurization products (biphenyl, diphenyl ether, diphenylamine, and benzene, respectively) in high yields. In contrast, 1 effects predominantly ring contraction during desulfurization and yields dibenzofuran, carbazole, and dibenzothiophene from 11, 12, and 13, respectively. From considerations of relative desulfurization rates for substituted dibenzothiphenes, deuterium labeling experiments, and the chemical reactivity differences for 1 and 2, it is concluded that these reagents desulfurize via single-electron-transfer mechanisms and that radical anions are crucial reactive intermediates. The greater reactivity of 2 is ascribed to its anionic nickel character.

9575 **Structural characterization of horseradish peroxidase using EXAFS spectroscopy. Evidence for Fe=O ligation in compounds I and II.** Penner-Hahn, J.E.; Eble, K.S.; McMurry, T.J.; Renner, M.; Balch, A.L.; Groves, J.T.; Dawson, J.H.; Hodgson, K.O. (Univ. of Michigan, Ann Arbor). *Journal of the American Chemical Society;* **108**: No. 24, 7819-7825(26 Nov 1986).

Extended X-ray absorption fine structure spectroscopy has been utilized to determine the structural environment of the heme iron sites in horseradish peroxidase compounds I and II. For comparison, analogous studies have been undertaken on putative ferryl (Fe/sup IV/=O) porphyrin model compounds and on crystallographically characterized Cr/sup IV/=O and Cr/sup V/ identical with N porphyrins. In a preliminary communication, they suggested that a short ca. 1.6 A Fe-O bond is present in the high valent forms of both the enzyme and the synthetic porphyrins. The present work demonstrates unambiguously that a short, ca. 1.64 A, Fe-O bond length is present both in HRP compounds I and II and in their synthetic analogues. This structure is consistent only with an oxo-ferryl (Fe=O) complex as the active oxygen species in horseradish peroxidase. The structural details, their implications for heme protein mediated oxygen activation, and the difference between their results and those recently published by other workers.

9576 **Sigmatropic [1,3]-hydrogen migration in a 1-silapropene.** Yeh, M.H. Linder, L.; Hoffman, D.K.; Barton, T.J. (Iowa State Univ., Ames). *Journal of the American Chemical Society;* **108**: No. 24, 7849-7451(26 Nov 1986).

The sigmatropic [1,3]-hydrogen migration in 1-silapropene is studied. This 1,3-allylic hydrogen shift is investigated using flash vacuum pyrolysis and deuterium NMR. Mechanisms and kinetics of the shift are proposed.

9577 **Ab initio studies of hydrocarbon peroxyl radicals.** Besler, B.H.; Sevilla, M.D.; MacNeille, P. (Oakland Univ., Rochester, MI). *Journal of Physical Chemistry;* **90**: No. 24, 6446-6451(20 Nov 1986).

Extensive ab initio molecular orbital calculations have been performed for the importance series of peroxyl radicals (O_2/sup .-/), HO_2/sup ./, CH_3O_2/sup ./, $(CH_3)_2CHO_2$/sup ./, and $(CH_3CH_2)_2CHO_2$/sup ./. Parameters calculated include equilibrium geometries, harmonic vibrational frequencies, dipole moments, and isotropic and anisotropic hyperfine couplings. Equilibrium geometries were of primary interest. In the two large hydrocarbon peroxyl radicals the carbon atoms and appropriate hydrogen atoms were constrained to be coplanar and the O-O group was forced to be perpendicular to the carbon chain in order to stimulate the presence of a peroxyl radical site in a polyethylene chain. Calculations were performed with large Gaussian basis sets (up to 6-311 ++G(d,p)). Calculations for HO_2/sup ./ including electron correlation utilizing Moeller-Plesset perturbation theory were performed at the following levels: MP2(6-31G(d)) and 6-311G(d,p), MP3(6-311G(d,p)) and MP4SDTQ(6-311(d,p)). Calculated values are compared against the highly accurate experimental data for HO_2/sup ./ known from microwave, laser magnetic resonance, and diode laser studies in order to determine the level of calculation necessary for accurate predictions. Comparison of the various calculations shows that MP2(6-31G(d)) compares favorably with MP4SDTQ(6-311G(d,p)) at a considerable savings in computation time.

9578 **In situ FTIR study of n-butane selective oxidation to maleic anhydride on V-P-O catalysts.** Wenig, R.W.; Schrader, G.L. (Iowa State Univ., Ames). *Journal of Physical Chemistry;* **90**: No. 24, 6480-6488(20 Nov 1986). Contract W-7405-ENG-82.

The selective oxidation of n-butane to maleic anhydride on vanadium-phosphorus-oxygen (V-P-O) catalysts having P to V ratios of 0.9, 1.0, and 1.1 was studied by transmission infrared spectroscopy. Catalysts were exposed to mixtures of 1.5% n-butane in air at temperatures from 100 to 500°C. Adsorbed n-butane, maleic anhydride, and carbon oxide species were observed on the catalyst surfaces. In addition, adsorbed maleic acid and highly reactive olefinic species could be detected. The nature of the adsorbed species present on the catalyst surface was dependent on the catalyst phosphorus loading, the reaction temperature, and the time of exposure under reaction conditions.

9579 **Small-angle neutron scattering study of the structural effects of substitution of tetramethylammonium for sodium as the counterion in dodecyl sulfate micelles.** Berr, S.S.; Coleman, M.J.; Jones, R.R.M.; Johnson, J.S. Jr. (Wake Forest Univ., Winston-Salem, NC). *Journal of Physical Chemistry;* **90**: No. 24, 6492-6499(20 Nov 1986). Contract AC05-84OR21400.

Small-angle neutron scattering (SANS) data have been obtained at 303 K for aqueous micellar solutions of $CH_3(CH_2)_{11}SO_4Na$ (sodium dodecyl sulfate (SDS)) and $CH_3(CH_2)_{11}SO_4N(CH_3)_4$ (tetramethylammonium dodecyl sulfate (TMADS)) and their deuterated analogues $CH_3(CH_2)_{10}CD_2SO_4Na$ (D_2-SDS) and $CH_3(CH_2)_{11}SO_4$ $N(CD_3)_4$ (D_{12}-TMADS). Results have been obtained for 0.4 mol dm^{-3} surfactant in various H_2O/D_2O mixtures and for TMADS as a function of surfactant concentration in D_2O. The SANS data are well described by charged, monodisperse hard spheres interacting through a screened Coulomb potential. The asphericity and the polydispersity of the systems were estimated to be small. The deuterium for the deuterated surfactants lies mainly in the Stern region of the micelle and increases contrast between the hydrocarbon core and the water-saturated Stern layer. Therefore, these deuterated micellar systems were used to determine the radius of the dry core, which was then used in the determination of the structural parameters for the micellar systems. The degree of hydration was determined without resorting to the assignment of values for the water of hydration for the individual ions present. It was found that TMADS micelles are smaller and have a higher charge, smaller degree of aggregation, and less but more deeply penetrating water than do SDS micelles. Both SDS and TMADS micelles had substantial amounts of hydrocarbon residing in the aqueous Stern layer.

9580 **Influence of sulfur on methanation over W(110).** Szuromi, P.D.; Kelley, R.D.; Madey, T.E. (National Bureau of Standards, Gaithersburg, MD). *Journal of Physical Chemistry;* **90**: No. 24, 6499-6507(20 Nov 1986).

The effect of adsorbed sulfur on the rate of methanation over W(110) is reported for a range of sulfur coverages (0.03-0.55 monolayers) and temperatures (600-750 K) for 1 Torr of CO and 100 Torr of hydrogen. The rate drops sharply for low sulfur coverages (by 40% at 0.05 monolayer) but decreases less dramatically for higher coverages. This contrasts with the data of Goodman and Kiskinova for Ni, which exhibits an order of magnitude drop for 0.05 monolayer S. Postreaction Auger spectra reveal that the sulfur-free surface for this sample is covered with both carbidic carbon and oxygen and is oxygen-rich. Increasing sulfur coverages leads to little change in the postreaction carbon level but does cause the oxygen coverage to fall substantially, to zero by 0.40 monolayer S. The activation energy for methanation is unaffected by the presence of sulfur, suggesting that the decrease in rate is caused by sulfur limiting the saturation coverages that can be attained by the reactants. This possibility motivated a thermal desorption study of CO and hydrogen adsorption on sulfur precovered surfaces. Good agreement is obtained between the changes in these saturation coverages and the decrease in methanation rate due to the presence of sulfur when small coverages of coadsorbed oxygen are present. The coverage of coadsorbed oxygen used in the thermal desorption measurements was based on the postreaction Auger spectra. These results taken as a whole suggest that the inhibiting effect of sulfur appears to be suppressed by the formation of sulfur clusters above ~ 0.05 monolayer S.

9581 **Catalytic composite for conversion of hydrocarbons and the method of preparation and use thereof.** Lambert, S.L.; Johnson, R.W.; Lawson, R.J.; Barr, T.L. (to Uop Inc., Des Plaines, IL). US Patent 4,623,632. 18 Nov 1986. Filed date 5 Nov 1984. v.p.

This patent describes a catalytic composite comprising an L-zeolite having deposited theron sufficient surface-deposited potassium to provide a surface-deposited alkali metal index of from about 40 to about 500 and from about 0.01 to about 5.0 wt. % of a platinum component based on the weight of the L-zeolite, the platinum component and the surface-deposited potassium.

9582 **Closed cyclone fcc catalyst separation with stripping gas injection and direct steam injection.** Haddad, J.H.; Owen, H. (to Mobil Oil Corp., New York, NY). US Patent 4,623,446. 18 Nov 1986. Filed date 21 May 1984. v.p.

This patent describes a method for the fluid catalytic cracking of a hydrocarbon feed in a closed cyclone system, comprising the steps of: passing a suspension of the hydrocarbon feed and a catalyst through a riser conversion zone and cracking the hydrocarbon feed in the riser conversion zone thereby producing a mixture comprising the catalyst, unconverted feed and products of conversion, wherein a downstream end of the riser is enclosed by a reactor vessel; passing the mixture from the riser conversion zone to a riser cyclone separator through a first conduit; separating a portion of the catalyst from the mixture in the riser cyclone separator by passing the mixture in the riser cyclone in downward spiral flow along an inside wall of a cylindrical chamber of the riser cyclone, the separated portion of catalyst passing from the cylindrical chamber into an upstream end of a frusto-conical chamber, the upstream end being attached to the cylindrical changer; and passing the separated portion of catalyst to a downstream end of the frusto-conical chamber, the downstream end of the chamber having a narrower inside diameter than the upstream end.

9583 **Sodium tetrachloroaluminate catalyzed process for the molecular weight reduction of liquid hydrocarbons.** Plummer, M.A. (to Marathon Oil Co., Findlay, OH). US Patent 4,623,445. 18 Nov 1986. Filed date 4 Dec 1984. v.p.

This patent describes a process for reducing the molecular weight of a high molecular weight hydrocarbon feedstock comprising contacting the feedstock with a molten tetrachloroaluminate catalyst. The catalyst consists essentially of NaAlCl/sub 4/, having substantially no excess NaCl or AlCl/sub 3/, at a pressure above atmospheric and at elevated temperature to produce a liquid product slate wherein the product slate has an average molecular weight substantially lower than the average molecular weight of the feedstock.

9584 **Hydrocarbon conversion.** Washer, S.P. (to Phillips Petroleum Co., Bartlesville, OK). US Patent 4,623,443. 18 Nov 1986. Filed date 7 Feb 1984. v.p.

A process is described for hydrogenating an olefin comprising cracking a hydrocarbon with a regenerated metal-coated catalyst under cracking conditions in a cracking zone, transferring the catalyst to a regeneration zone where it is contacted with an oxygen-containing gas and regenerated. Portions of the regenerated catalyst are continually transferred to the cracking zone while continually transferring other portions to a reduction zone wherein the catalyst is exposed to a reducing gas under conditions to reduce the metals thereon. The cracking hydrocarbons are transferred to a separating zone where H/sub 2/ and olefins are separated from the rest of the products, contacting at least a portion of the hydrogen and olefins with the thus reduced catalyst in a hydrogenation zone hydrogenating the olefins, transferring the products to the separation zone, and transferring the catalyst to the regeneration zone.

9585 **Semiclassical calculation of molecular vibrations from ab initio potentials using splines: ozone.** Noid, D.W.; Knudson, S.K.; Koszykowski, M.L.; Renka, R.J. (Oak Ridge National Lab., TN). *Journal of Physical Chemistry;* **90**: No. 23, 6135-6138(6 Nov 1986). Contract AC05-84OR21400.

A numerical technique employing spines under tension is applied to obtain a two-dimensional potential and forces from a potential energy surface known only pointwise. Classical trajectories for this potential surface can then be found by numerical integration. The surfaces of section computed from trajectories for a model problem show that the semiclassical actions so generated are virtually identical with the actions generated with the analytic forces. Application of this technique to determine the ground-state vibrational frequencies of ozone using a Gaussian 82 potential energy surface gives results in good agreement with experiment.

9586 **Molecular structure of the nitrile ylide derived from 3-phenyl-2H-azirine in a nitrogen matrix.** Orton, E.; Collins, S.T.; Pimentel, G.C. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **90**: No. 23, 6139-6143(6 Nov 1986).

Nitrile ylides derived from 3-phenyl-2H-azirine and five of its isotope-labeled counterparts were generated photochemically in 12 K nitrogen matrices and examined by FTIR. A prominent 1926-cm^{-1} feature in the unlabeled ylide's spectrum undergoes a 66-cm^{-1} shift with ^{15}N substitution, and this effect is interpreted as being consistent only with the asymmetric stretching fundamental of a linear $^{-}C{=}^{+}N{=}C$ skeleton. The spectra of the ^{13}C- and D-labeled nitrile ylides corroborate this conclusion and clarify spectral regions where Fermi multiplets and overlapping absorptions complicate the interpretation. The allene-like nitrile ylide C/sub s/ geometry is retained over the temperature range 12-82 K, which suggests that this geometry is also adopted in solution where ylides have been implicated as 1,3-dipolar reactive intermediates from the photolysis of 2H-azirines.

9587 **Theoretical study of the time dependence of the production of excited N_2 by subexcitation electrons in rare-gas mixtures.** Naleway, C.; Inokuti, M.; Sauer, M.C. Jr.; Cooper, R. (Argonne National Lab., IL). *Journal of Physical Chemistry;* **90**: No. 23, 6154-6158(6 Nov 1986).

Experimental data are available which suggest that the fast production of electronic excited states in electron-irradiated helium-(or neon-) nitrogen mixtures is due to the interactions of subexcitation electrons. These systems - helium or neon with trace only amounts of N_2 - lend themselves to theoretical analysis by various methods. Using only well-established cross-section data for inelastic processes in these systems allows the time dependence of the evolution of emission from the $C^3\Pi$/sub u/ state of N_2 to be calculated. The results of these calculations show (i) support for the subexcitation electron mechanism; (ii) that the continuous slowing down approximation is inappropriate in these systems; (iii) that a Monte-Carlo technique gives satisfactory agreement between theory and experiment; and (iv) that more reliable data and a closer analysis of it will assist further development of these ideas.

9588 **Photodissociation studies of HNCO: heat of formation and product branching ratios.** Spiglanin, T.A.; Perry, R.A.; Chandler, D.W. (Sandia National Labs., Livermore, CA). *Journal of Physical Chemistry;* **90**: No. 23, 6184-6189(6 Nov 1986).

The heat of formation (ΔH/sub f/(298 K)) of HNCO is determined to be -24.9/sub -2.8//sup +0.7/ kcal/mol (based on ΔH/sub f/(NH) = 85.2 kcal/mol). This value is obtained by measuring the threshold for the production of NH($a^1\Delta$) and by determining the energy contents of the NH fragment and the CO cofragment produced by photolysis of HNCO at wavelengths near the threshold. Saturated laser-induced fluorescence is used to determine the internal state distribution of NH($a^1\Delta$), and multiphoton ionization is used to measure the internal state distribution of CO. An upper limit for the branching ratio of NCO/NH production from photodissociation of HNCO at 193 nm is determined from an analysis of kinetic experiments to be 0.10. To clarify the mechanism of photodissociation, HNCO fluorescence-excitation and NH($a^1\Delta$) action spectra are also measured. They imply that two excited states of HNCO are present where only one had previously been considered.

9589 Optimization of weak neutral dimers in nozzle beams. Grover, J.R.; Walters, E.A. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **90**: No. 23, 6201-6210(6 Nov 1986). Contract AC02-76CH00016.

A method is described for the optimization of conditions to produce neutral dimers in molecular beams collimated from gas jet expansions, including expansions of binary gas mixtures. The method makes use of the dependence on nozzle pressure of the observed relative ion intensities produced by energetic ($\geqq$20 eV) photons or electron impact. Relative dimer beam densities are obtained, and ratio of neutral trimers to neutral dimers around the nozzle pressure at which the neutral dimers are a maximum can be estimated. For the expansion of gas mixtures, the neutral dimer optimization is in principle for a composite of heterodimer and homodimers, but nevertheless conditions often permit the optimization of a single species, or nearly so. In the several cases studied to date the photoionization of clusters is always highly dissociative, with dimers forming mainly monomer ions, and trimers forming mainly dimer and monomer ions. Therefore the direct use of cluster ion intensities to estimate the relative beam intensities of the corresponding neutral clusters is invariably misleading.

9590 Coadsorption of oxygen and hydrogen on Ru(001): blocking and electronic effects of preadsorbed oxygen. Hrbek, J. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **90**: No. 23, 6217-6222(6 Nov 1986). Contract AC02-76CH00016.

The coadsorption of oxygen and hydrogen on Ru(001) at 80 K has been studied by thermal desorption, work function measurement, low-energy electron diffraction, and Auger spectroscopy. Oxygen adsorbed in an ordered p(2 x 2) layer induces formation of new weak adsorption sites within each unit cell and simultaneously blocks the adsorption of hydrogen in the sites typical of a clean surface. Hydrogen adsorbs dissociatively with a high sticking probability in the modified sites, and the adsorption is accompanied by a small but complex work function change. The authors propose that weakly bound hydrogen occupies both surface and subsurface threefold sites. With oxygen coverage increasing above 0.25, the new adsorption sites are progressively blocked and on a surface saturated by a p(1 x 2) oxygen layer the adsorption of hydrogen is completely inhibited. The coadsorption phenomena are dependent upon the sequence of adsorption in preparing the coadsorbed layer and on the ordering of the preadsorbed layer. They also find the hydrogen overlayer suppresses completely the oxygen adsorption.

9591 ESR study of free-radical protonation equilibria in strongly acid media. Davis, H.F.; McManus, H.J.; Fessenden, R.W. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **90**: No. 23, 6400-6404(6 Nov 1986).

Protonation of ascorbic acid radical, HPO_3^-, and SO_3^- in strong perchloric acid solution has been studied by means of changes in ESR parameters. The behavior of the ascorbic acid radical shows that the use of published acidity functions does not well describe the observations in that changes in ESR parameters occur over a much wider range of acidity function than expected. Treatment in terms of an equilibrium involving $H^+(H_2O)_4$ works much better. The pK so determined is -0.86 +/- 0.1 in contrast to an earlier value of -0.45. A continuous increase in ^{31}P hyperfine constant for HPO_3^- was observed from 650 G at pH 2.4 to 772 G at 61.2% $HClO_4$. This change could not be explained by a single protonation to H_2PO_3, but if a second step giving $H_3PO_3^+$ was also included a reasonable fit to the data could be obtained. Approximate pK values of 0.0 and -1.7 were found for the first and second steps, respectively. No systematic change in the g factor for phosphite radical outside of the error limits +/- 0.00008 was found over the whole range. The radical SO_3^- was produced over the range from pH 11.3 to 61.2% $HClO_4$ and no change in the g factor larger than +/- 0.00001 was found. It is possible that this radical does protonate to HSO_3 but that no change in g factor accompanies this transformation.

9592 Molecular hydrogen complexes of the transition metals. 4. Preparation and characterization of $M(CO)_3(PR_3)_2(eta^2\text{-}H_2)$ (M = Mo, W) and evidence for equilibrium dissociation of the H-H bond to give $MH_2(CO)_3(PR_3)_2$. Kubas, G.J.; Unkefer, C.J.; Swanson, B.I.; Fukushima, E. (Los Alamos National Lab., NM). *Journal of the American Chemical Society;* **108**: No. 22, 7000-7009(29 Oct 1986).

The syntheses, properties, and spectral characterization of the first examples of molecular hydrogen complexes, $M(CO)_3(PR_3)_2$(M = Mo, W; R_3 = Cy_3, i-Pr_3, Cy_2-i-Pr), are reported in full. All six of the expected fundamental vibrational modes for eta^2-H_2 binding including v(HH) at 2690 cm^{71}, have been located. The hydrogen atoms of the H_2 ligand, but not of the phosphines, undergo exchange with D_2 to give HD, even in the solid state. Solid state ^2H NMR of $W(CO)_3(P\text{-i-}Pr_3)_2(D_2)$ shows rapid rotation of the D_2 about the metal-D_2 axis. IR and variable-temperature ^1H and ^{31}P NMR of solutions of the H_2 complexes reveal the presence of equilibrium amounts (10-30%) of a species that the data indicate is a 7-coordinate dihydride, $MH_2(CO)_3(PR_3)_2$. The latter is presumably formed by dissociation of the H-H bond, thus completing oxidative addition of H_2 to the metal. The dihydride is fluctional, but low-temperature NMR spectroscopy shows that both the hydride and phosphorus ligands are inequivalent. At -80°C the T_1 value for the ^1H NMR signal of the H_2 ligand is 0.004 s, almost three order of magnitude less than that of the hydride protons (1.7 s) in $WH_2(CO)_3(P\text{-i-}Pr_3)_2$.

9593 Preparation of novel metal-rich transition-metal sulfides and selenides by high-temperature techniques. Franzen, H.F. (Iowa State Univ., Ames). *Journal of Solid State Chemistry;* **64**: No. 3, 283-286(Oct 1986). Contract W-7405-ENG-82.

The techniques used for the preparation of metal-rich chalcides by high-temperature techniques are discussed. The two newest metal-rich compounds, two ternary metal-rich sulfides with novel structures, are described.

9594 Thermodynamics of aqueous solutions of the alkali metal sulfates. Holmes, H. F.; Mesmer, R.E. (Oak Ridge National Lab., Oak Ridge, TN). *Journal of Solution Chemistry;* **15**: No. 6, 495-518(Jun 1986).

The available thermodynamic properties for aqueous solutions of each of the alkali metal sulfates have been combined and analyzed within the framework of the ion interaction model at temperatures up to 225°C. It was necessary to set α_1 equal to 1.4 kg / SUP 1/2/ -mol /SUP 1/2/ in order to obtain a satisfactory fit. The temperature dependence of the ion interaction parameters was given the functional form used by Rogers and Pitzer in their study of Na_2SO_4(aq). With few exceptions, it was possible to reproduce the available thermodynamic data for aqueous solutions of the alkali metal to within the estimated experimental error. Thermodynamic results for Na_2SO_4(aq) appear to be adequate in this temperature range, but enthalpy and heat capacity data for the other alkali metal sulfate solutions are conspicuously lacking. Activity coefficients of these electrolytes decreased to less than 0.1 at moderate molalities at the higher temperatures, and their order changed with increasing temperature; two results which could be due to a combination of hydration and association effects.

9595 Use of the semi-equilibrium dialysis method in studying the thermodynamics of solubilization of organic compounds in surfactant micelles. system n-hexadecylpyridinium chloride-phenol-water. Smith, G.A.; Christian, S.D.; Scamehorn, J.F.; Tucker, E.E. (Univ. of Oklahoma, Norman, Ok). *Journal of Solution Chemistry;* **15**: No. 6, 519-529(Jun 1986).

The semi-equilibrium dialysis method has been used to infer solubilization equilibrium constants or, alternatively, activity coefficients of solutes solubilized into micelles of aqueous surfactant solutions. Methods are described for inferring the concentrationa of monomers of the organic solute and of the surfactant on both sides of the dialysis membrane, under conditions where the organic solute is in equilibrium with both the high-concentration (retentate) and low-concentration (permeate) solutions. By using a form of the Gibbs-Duhem equation, activity coefficients of both phenol (the solubilizate) and n-hexadecylpyridinium chloride (the surfactant) are obtained for aqueous solutions at 25 °C throughout a wide range of relative compositions of surfactant and solubilizate within the micelle. The apparent solubilization constant, K = (solubilized phenol)/((monomeric phenol) (micellar surfactant)), is found to decrease significantly as the mole fraction of phenol in the micelle increases.

9596 **Thermodynamics of tri- and pentabromide anions in aqueous solution.** Rmette, R.W. (Carteton College, Northfield, MN). *Journal of Solution Chemistry;* 15: No. 5, 387-396(May 1986).

Formation constants for the tribromide and pentabromide anions were measured by a vapor partitioning method from 5 to 80 degree C. The molal thermodynamic parameters for these respective species at 25°C are: K_3 = 16.73, Δ H = -5.90 kJ-mol^{-1}, ΔCp° = -29 J-K^{-1} mol^{-1}, and ΔS° = 3.6 J-K^{-1}-mol^{-1}; K_5 = 37.7, Δ° = -13.0 kJ-mol^{1-}, ΔS° =-13.6 J-K^{-1}, with Δ Cp° zero. These results are used to reevaluate published emf results for the bromine/bromide couple.

9597 **Modified Raoult's law including the solvent structural constant and solute solvation; aqueous sodium chloride solutions, 25 to 300°C; other electrolytes and urea, 25°C.** Marshall, W.L. (Oak Ridge National Lab., Oak Ridge, TN.). *Journal of Solution Chemistry;* 15: No. 5, 439-452(May 1986).

The form of Raoult's law is modified to express the activity of water (a(H_2O)) for aqueous electrolyte solutions by the mole fraction of a free (nonsolvating) solvent structural unit raised to the reciprocal power of the solvent structural constant. Relatively close agreement with experiment is obtained for a(H_2O) of aqueous sodium chloride solutions up to 300°C and nearly saturated concentrations, and of other aqueous electrolyte solutions at 25°C. In an example for aqueous-organic systems, a(H_2O) for urea solutions at 25°C is described with an average deviation of 0.09% for molalities from 0 to 20m (54.6 wt%) by using the necessary (universal) structural constant and a single solvation parameter.

9598 **Picosecond spectroscopic evidence of chain ordering in 1-n-dodecanol.** Wirth, M.J.; Blanchard, G.J. (Lawrence Livermore Lab., Livermore, CA 94550). pp 597 of Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy. Abstracts. Pittsburgh, PA; Pittsburgh Conference (1986). (CONF-860309—).

From 37. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (10 Mar 1986).

Liquid structure is important to fundamental analytical chemistry both for its effects on spectroscopic measurements and for its ultimate application to chromatographic separation. Liquid structure is not nearly as straightforward to characterize as solid state structure. Typically, a batter of techniques is used to gain indirect structural information, and the structure is inferred from the combined information. More techniques need to be developed to aid in determining liquid structure. In this paper, picosecond spectroscopy is shown to be a sensitive tool for identifying a structurally ordered phase of liquid n-dodecanol existing at room temperature. The existence of such a phase was previously unknown. The dye cresyl violet was used as a structural probe for electronic spectroscopic measurements. The experimental study involved the use of both the spectral shift and rotational diffusion behavior of cresyl violet, as well as NMR relaxation measurements and determination of optical properties. These studies provide information about the nature of the ordered phase, its microviscosity, and the temperature range over which the phase exists. The significance of the structured phase in n-dodecanol is that the structure involves alkyl chain alignment without the need for polar groups on both ends of the molecule. This provides for the existence of a nonpolar functional group that has both structural order and low viscosity, which are two characteristics valuable in the design of chromatographic stationary phases.

9599 **(ORNL/tr—86/57) Epoxy Schiff base resin manufacturing method.** Kimura, Takao. (Oak Ridge National Lab., TN (USA); Nippon Telegraph and Telephone Public Corp., Tokai, Ibaraki. Ibaraki Telecommunication Lab.). [1986]. Contract AC05-84OR21400. Translation of Japanese Patent 51-155115, December 24, 1976. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002423.

A manufacturing method for epoxy Schiff base resin is described, characterized by the fact that at least one or more types of dicarboxylic acid having an azomethyne compound represented by the general expression: HOOC-R_1-N=HC-R_2-COOH, HOOC-R_1-N=HC-R_3-CH=N-R_1-COOH, HOOC-R_1-CH=N-R_4-N=HC-R_2-COOH (R_1, R_2, R_3 and R_4 are bivalent [radicals] of the aromatic group or aliphatic group) and epoxy compound having at least two epoxy radicals in one molecule interact through heating in a solvent in which dicarboxylic acid of the Schiff base is dissolved.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 9223, 9224, 9596, 9597

9600 **(GKSS—85/E/51) The technical application of electrodialysis.** Kneifel, K. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1985. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900266.

The principle of electrodialysis is described along with the construction of membrane stacks and plants. The most important plant design parameters are explained for selected applications in water treatment and in recovery of valuable products. It is shown, that the stack design depends on the fact whether solvent or solute is the desired product.

9601 **(LBL—22036) Limiting-current technique at a sectioned electrode for the study of buoyancy-induced convection.** Whitney, G.M.; Tobias, C.W. (California Univ., Berkeley (USA). Dept. of Chemical Engineering; Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 43p. (CONF-861211—14). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001716.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

The onset of convective motion is investigated for a case in which the density profile is evolving in time in a semi-infinite fluid, due to a step change in surface concentration at a rigid, conducting boundary. The limiting current technique at a micro-mosaic electrode, which is composed of 100-μm, square elements, is used to effect the concentration change and to monitor the resulting mass transfer. The equations of transient mass transport by diffusion and migration and the equation of electroneutrality are solved numerically to determine the concentration and density profiles before the onset of convection. The critical Rayleigh number, based on the penetration depth of the concentration profile, was found to be approximately 1350 and to increase with increasing size and decreasing sensitivity of the sensing element. 39 refs., 13 figs., 1 tab.

9602 **(LBL—22105) Structure-property relations for surface processes at the metal/solution interface.** Ross, P.N. (Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 28p. (CONF-861019—16). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001890.

From 10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society; Baltimore, MD, USA (27 Oct 1986).

The recent development of special apparatus coupling electroanalytical cells directly to UHV surface analytical chambers has made possible definitive determination of structure-property relations for processes at metal electrode surfaces. The results have been surprising. The process of submonolayer metal ion deposition (so-called underpotential deposition) exhibits unexpected sensitivity to long-range order in the substrate, indicating that lateral bonding forces are of the same magnitude as the perpendicular bonding force. On a well-ordered Pt(111) surface, unexpected new surface processes have been observed that are unique to this surface, i.e., are not seen on either (100) or (110) surfaces, nor on polycrystalline surfaces. It appears that the new processes are associated with atomically flat regions of the (111) surface with a critical region size that is quite large, at least 2 nm. It is suggested that cooperative interactions in the double-layer form a critical ensemble that react to form the new surface species. However, much further study utilizing in-situ spectroscopy will be required to understand this new surface process in Pt(111).

4005 Photochemistry

REFER ALSO TO CITATION(S) 9054, 9538, 9586, 9588, 9627

9603 **(DOE/ER/03416—T3) The free-radical and ion chemistry of volatile silanes, germanes and phosphines: Informal technical report, August 1, 1985-October 31, 1986.** Lampe, F.W. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1986. Contract AC02-76ER03416. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003144.

This report is divided into 2 main sections: photochemical studies and ion-molecule reactions. The discussions listed under photochemical studies are: infrared laser photochemistry of SiH_4-CH_3Cl mixtures; infrared laser photochemistry of SiH_4-NO mixtures; infrared laser photochemistry of SiH_4-D_2 mixtures; the reaction of GeH_3 radicals with NO; and the infrared laser photochemistry of silane. Under ion-molecule reactions, the reactions of Si^+ ions with methylsilane and ethane are discussed. 9 refs. (PLG)

9604 **(LBL—22142) Photodissociation of water over doped iron oxides: materials and mechanisms.** Hendewerk, M.L. (California Univ., Berkeley (USA)). Nov 1985. Contract AC03-76SF00098. 206p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE87001724.

The main goal of this project has been to study the possibility of economically converting solar energy to chemical energy. It was found that two iron oxide electrodes, one containing MgO and the other SiO_2, connected to form a short circuited assembly would successfully photodissociate water when illuminated with light. No external energy source was necessary. The power conversion efficiency of this cell proved to be low. Extensive research followed in which the Mg-doped electrode and the short circuited assembly were thoroughly characterized. Although the Mg-doped material is not a true p-type semiconductor, it possesses very unique properties. As a supplement of these studies and as a correlation to water photodissociation, experiments have been performed using ultra high vacuum techniques (thermal desorption spectroscopy, ultraviolet photoelectron spectroscopy, and x-ray photoelectron spectroscopy) to study the reaction of H_2O with stoichiometric and partially reduced single crystals of α-Fe_2O_3 (basal plane). K was added to simulate the presence of alkali metals in the electrolyte solution used in the short circuited assemblies. Reduced iron oxides were produced which are stable to relatively high temperatures (500 K) due to an oxidized outermost layer.

9605 **Selectivity in the laser-induced photochemistry of I_2 + C_2H_2 in the gas phase.** Yappert, M.C.; Yeung, E.S. (Iowa State Univ., Ames). *Journal of the American Chemical Society;* **108**: No. 24, 7529-7533(26 Nov 1986). Contract W-7405-ENG-82.

The reaction between I_2 and acetylene has been carefully studied to establish its potential use for the separation of radioactive isotopes of iodine. The two possible photoproducts, cis- and trans-1,2-diiodoethylene, were prepared and then characterized by GC, GC-MS, and FTIR in both condensed and gas phases. For the first time the IR spectra of both cis and trans isomers in the gas phase are reported. Below the dissociation energy, when either the ortho or para modifications of I_2 were excited, only the trans isomer was found as a product. Studies conducted with isotopic mixtures of $^{127}I_2$, $^{129}I_2$ and ^{127}I, ^{129}I revealed that the reaction proceeds by the addition of iodine atoms to acetylene. The production of atoms leads to isotopic scrambling. Consequently, this reaction cannot be used to separate the isotopes of iodine, as previously postulated.

9606 **Effect of light intensity on the quantum yield of photoinduced electron transfer from colloidal cadmium sulfide to methylviologen.** Nosaka, Y.; Fox, M.A. (Univ. of Texas, Austin). *Journal of Physical Chemistry;* **90**: No. 24, 6521-6522(20 Nov 1986).

The quantum yield Phi for the reduction of methylviologen on pulse-irradiated colloidal CdS particles was measured as a function of incident light intensity. The experimental data were successfully simulated with a numerical kinetic analysis. The relationship between Phi and light intensity and the rate constant for electron-hole recombination were obtained.

4006 Radiation Chemistry

9607 **(CEA-CONF—8244) Simulation; an everyday tool for research in chemical kinetics.** Nakhle, M.; Roux, P.; Thomas de Montpreville, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Aug 1985. 6p. (CONF-850861—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750712.

From 11. International Association of Mathematics and Computers Simulation world congress; Oslo, Norway (5 Aug 1985).

In order to make apparent the facilities offered by the NEPTUNIX package in solving some complex problems in chemical kinetics, the paper deals with its application to a particular example taken from material science: assistance to the validation of mechanisms governing colloids growth in a fluorite crystal when it is irradiated by an electron beam.

9608 **(CEA-CONF—8485) Gamma radiolysis of sugars in solid or liquid phase: spin-trapping study by ESR/HPLC analysis.** Raffi, J.; Agnel, J.P.; Battesti, C.; Tiery, C.; Vincent, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Jun 1985. 6p. (CONF-8606229—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750774.

From 3. workshop on radiations chemistry; Autrans, France (10 Jun 1986).

The radicals induced in sugars irradiated in polycrystalline state or in aqueous solution are compared using the spin trapping method. The efficiency of ESR/HPLC analysis is shown using examples.

9609 **(UJV—7379-CH) Structure of physics and the chemical or biological action of ionizing radiations - rarely employed ideas.** Bednar, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Jul 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700260.

The fact is pointed out that phenomena in radiochemistry and micro-scale radiobiology are non-linear similar to phenomena in modern theoretical physics. A comparison is made of the conceptual development of theoretical physics and of theoretical radiation biology. The use of Bose-Einstein's exciton condensation is suggested for expressing the non-linearity of radiochemical and radiobiological processes.

9610 **(ZfI-Mitt—113) Time-resolved ESR spectroscopy. Fundamentals and applications in the fields of radiation chemistry and photochemistry.** Beckert, D. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1986. 163p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87700214.

The time-resolved ESR spectroscopy is one of the modern methods in radiospectroscopy and plays an important role in solving various problems in chemistry and biology. Proceeding from the basic ideas of time-resolved ESR spectroscopy the experimental equipment is described generally including the equipment developed at the Central Institute of Isotope and Radiation Research. The experimental methods applied to the investigation of effects of chemically induced magnetic polarization of electrons and to kinetic studies of free radicals in polymer systems are presented. The theory of radical pair mechanism is discussed and theoretical expressions are summarized in a computer code to compute the theoretical polarization for each pair of the radicals.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 8906, 9025, 9411, 9512, 9605, 10039, 10056

9611 (CEA-CONF—8392) **Electroprecipitation of potassium americyl carbonate from potassium carbonate solutions.** Berger, P.; Bourges, J.; Nguyen, T.H. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Sep 1985. 13p. (In French). (CONF-8509147—27). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750717.

From ACTINIDES '85; Aix-en-Provence, France (1 Sep 1985).

Precipitation of potassium americyl carbonate was carried out at multigram scale by oxidizing at platinum anode Am(III) in 3 M K_2CO_3 solutions. Early investigations were conducted on pure americium 241 solutions on 10 to 40 mg scale, in order to study the different parameters of the electrolysis, and to prove the faisability of the process. Further experiments have been performed on the 20 grams scale, in impure americium 241 solutions. Electrolysis performed at 60°C with platinum grid as anode, and tantalum rod immersed in a cathodic compartment, precipitates 20 grams of americium 241 with yields above 99% in two hours. The electroprecipitation process presents the advantage to be clean and suitable for automation technique in comparison with the chemical oxidation process using potassium persulfate.

9612 (CEA-CONF—8457) **Structural features of uranium IV borohydride and of $U(BH_4)_4L_4$ adducts.** Charpin, P.; Chevrier, G.; Lance, M.; Nierlich, M.; Vigner, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 4p. (CONF-8604262—1-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750241.

From 16. meeting on actinides; Eibsee, F.R. Germany (28 Apr 1986).

Published in summary form only.

9613 (DPST—84-627) **Physical measurements for online determination of free acid and uranium concentrations.** Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 17 Jul 1984. Contract AC09-76SR00001. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002638.

Online analyzers for Separations Area process control should be as simple as possible. We have demonstrated that in some instances nonintrusive physical measurements can be used to determine chemical concentrations. For example, free acid concentration can be derived from conductivity and temperature. We plan to extend the use of physical measurements for online chemical determinations to process solutions in which uranium, as well as acid, is a major component. Physical measurements in addition to conductivity can be used: namely, optical absorbance, density, and gamma activity. By combining these measurements, determination of both uranium and acid concentrations is possible. This memorandum describes results of statistically designed experiments to determine the applicability of this approach for three acid-uranium combinations typical of Separations Area process solutions. These comprehensive results are to be used as guidelines for evaluation and implementation of this technology for specific applications. 3 refs., 34 figs., 9 tabs.

9614 (IPNO-DRE—85-29) **Solid state physics and actinide spectroscopy.** Delamoye, P.; Hubert, S.; Khan Malek, C.; Krupa, J.C.; Simoni, E.; Genet, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 38p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750736.

We studied the physical and spectroscopic properties of $ThBr_4$ and $ThCl_4$. We made first a synthesis and studied the crystal growth to determine the uranium concentration in the crystals. This work allows an interpretation of the optical properties of an ion embedded in an incommensurate structure.

9615 (IPNO-T—85-08) **Spectroscopic properties of tetravalent uranium in the incommensurate phase of thorium tetrabromide.** Delamoye, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Apr 1985. 258p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE87750738.

This thesis includes: the complete visible and infrared absorption (emission) spectra of U^{4+} as doping ion in pure $ThBr_4$, as well as the magnetic circular dichroism (MCD) measurements have been examined. At liquid - He temperature the absorption spectra consist of broad absorption bands with two edge singularities. The apparently continuous character of fluorescence lines in selective excitation experiments, and the MCD profiles suggest the existence of a continuous distribution of U^{4+} sites in the host crystal. Raman scattering results indicate the existence of a displacive phase transition at Tsub(c) = 95 K. X-ray and neutron powder diffraction data show additional lines. Single-crystal neutron diffraction measurements indicate that below Tsub(c) $ThBr_4$ has a displacively modulated structure. Inelastic neutron scattering leads us to understand the dynamics of the phase transition. In conclusion this study led us to give a complete interpretation of the optical properties of an ion embedded in an incommensurate structure.

9616 (K/PS—798) **The solubility of uranium hexafluoride in perfluoroethers.** Barber, E.J. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Jul 1984. Contract AC05-84OT21400. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002525.

The polyperfluoroethers are compatible with uranium hexafluoride (UF_6) and are suitable for use in diffusion pumps and in mechanical vacuum pumps which rely on oil as both the lubricant and the seal. The UF_6 is soluble in all fluids with which it is compatible. Because a number of vacuum pumps in the BOP facilities of the GCEP plant employ these perfluoroether oils as the working fluid and have oil chambers which are large, questions have been raised as to the relationships governing the solubility of UF_6 in these materials and the maximum quantities of UF_6 which could be dissolved in these oils under credible accident conditions. This report summarizes these solubility relations and the interaction of the UF_6 solubility and the pumping capability of this type of vacuum pump. It will be shown that, whereas the solubility of UF_6 in Fomblin Y25 fluoroether fluid under a UF_6 pressure of 760 torr and at the pump operating temperature of 160°F is about 500 g of UF_6 per liter of oil, the system controls are such as to isolate the system from the pumps before the quantity of UF_6 dissolved in the perfluoroether exceeds about 10 g of UF_6 per liter of oil. 13 refs., 7 figs.

9617 (KFK—4095) **Behavior of sorption and thermal desorption of fission products from loaded metal oxide exchangers.** Buerck, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). Aug 1986. 165p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87750313.

A new sublimation method for the concentration and purification of ^{99}Mo, produced by the fission of ^{235}U with thermal neutrons, has been developed to replace the present final decontamination steps in the various well established ^{99}Mo separation processes. A distinct simplification and shortening of the actual procedure is obtained by combining the chromatographic sorption on the SnO_2-exchanger with the direct thermal desorption of the Mo product from the oxide.

9618 (KURRI-TR—249, pp 116-121) **Recoil tritiation of pseudouridine.** Kusama, Keiichi. (Shizuoka Univ., Japan. Faculty of Science). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

The tritiation of pseudouridine, one trace component of RNA, has been investigated in the author's laboratory. As a part of the investigation, the tritiation of pyrimidines including uracil, uridine and pseudouridine was examined. Catalytic tritiation in which hydrogen is exchanged in tritium water using a catalyst, Wilzbach method in which hydrogen is exchanged in tritium gas, and recoil tritiation in which hydrogen is exchanged with the recoil tritium atoms generated by the reaction of Li(6) with thermal neutrons were compared experimentally. The desirable hydrogen to be exchanged with tritium is a hydrogen atom bonded to the 6th position carbon atom in pyrimidine rings, and it was found that the recoil tritiation was favorable to such exchange. Candidate recoil tritiation procedures such as irradiation in the Pn-3, in the Slant tube, in old LTL and in new CTi were examined comparatively, and the irradiation in old LTL exhibited excellent results. In the old LTL, the influence of temperature, degree of vaccum and the partial pressure of He on the merit was measured, and the preferable condition was obtained.

9619 (ZfK—570) Annual report 1984. Radioactive Isotope Department. Muenze, R. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Nov 1985. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700315.

New technologies for production and application of radionuclides and synthesis of radioactive compounds are reported. Special importance is attributed to the characterization of radioactive compounds and the quality check of /sup 99m/Tc- and ^{14}C-labelled complexes within animal tests. An extensive list of publications and lectures illustrates the international cooperation of research in the field of radiochemistry.

9620 (ZfK—571) Annual report 1984. Nuclear Fuel Research Department. Nebel, D. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Dec 1985. 172p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87700316.

Research activities have been reviewed in the field of powder metallurgy and the production of new ceramic materials in particular silicon nitrides. Communications on the chemistry of solutions and the analytical chemistry have been compiled specially under the aspect of technical solutions and the development of new devices, equipments and methods. In a final chapter publications and lectures are assorted.

9621 Rate constant determination of the reaction of metastable $N(^2D,^2P)$ with NO_2 using moderated nuclear recoil atoms. Iwata, R.; Ferrieri, R.A.; Wolf, A.P. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **90**: No. 25, 6722-6726(4 Dec 1986). Contract AC02-76CH00016.

The kinetics of the reaction $N(^2D,^2P) + NO_2$ were studied by using moderated nuclear recoil atoms to generate thermalized metastable atomic nitrogen, ^2D and ^2P, at a $[NO_2]/[N]$ ratio of 10^{13}. Branching ratios were obtained for the following channels of reaction: $N + NO_2 \rightarrow N_2O + O$ (k/sub 1a/); $N + NO_2 \rightarrow 2NO$ (k/sub 1b/); $N + NO_2 \rightarrow N_2 + O_2$ (k/sub 1c/); $N + NO_2 \rightarrow N_2 + 2O$ (k/sub 1d/). The distribution of channels 1a:1b:(1c + 1d) was measured to be 1.00:0.65:0.27. An upper limit for the overall rate constant for reaction was also evaluated at 3.3×10^{-13} cm^3 molecule^{-1}s^{-1} (293 K) by using competitive kinetic measurements of the formation of radioactive nitrogen-13 labeled products. This rate constant is at least an order of magnitude smaller than previously reported values for the ground-state $N(^4S) + NO_2$ reaction.

9622 Dynamic polarization of ^{13}C in ethylene-1,2-$^{13}C_2$ glucol. Jarmer, J.J.; Penttilae, S.; Hill, D.; Kasprzyk, D.; Krumpolc, M.; Barlett, M.L.; Hoffmann, G.W.; Ray, L. (Los Alamos National Lab., NM, USA; Argonne National Lab., IL, USA. High Energy Physics Div.; Illinois Univ., Chicago, USA; Texas Univ., Austin, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **250**: No. 3, 576-578(20 Sep 1986). Contract W-31-109-ENG-38;AS05-80ER10638.

Letter-to-the-editor.

The ^{13}C nuclei in ethylene-1,2-$^{13}C_2$ glycol have been dynamically polarized to 28%. The material appears suited for use as a polarized nuclear target for intermediate energy hadron+^{13}C scattering experiments.

9623 The chemistry of the actinide elements, Volume II. Katz, J.J.; Seaborg, G.T.; Morss, L.R. New York, NY; Methuen, Inc. (1986). 912p. Methuen, Inc., 733 Third Avenue, New York, NY 10017.

The Chemistry of the Actinide Elements is an exposition of the chemistry and related properties of the 5f series of elements: actinium, thorium, protactinium, uranium and the first eleven. This second edition has been completely restructured and rewritten to incorporate current research in all areas of actinide chemistry and chemical physics. The descriptions of each element include accounts of their history, separation, metallurgy, solid-state chemistry, solution chemistry, thermo-dynamics and kinetics. Additionally, separate chapters on spectroscopy, magnetochemistry, thermodynamics, solids, the metallic state, complex ions and organometallic compounds emphasize the comparative chemistry and unique properties of the actinide series of elements. Comprehensive lists of properties of all actinide compounds and ions in solution are given, and there are special sections on such topics as biochemistry, superconductivity, radioisotope safety, and waste management, as well as discussion of the transactinides and future elements.

9624 The chemistry of the actinide elements, Volume I. Katz, J.J.; Seaborg, G.T.; Morss, L.R. New York, NY; Methuen, Inc. (1986). 998p. Methuen, Inc., 733 Third Avenue, New York, NY 10017.

The Chemistry of the Actinide Elements is a comprehensive, contemporary and authoritative exposition of the chemistry and related properties of the 5f series of elements: actinium, thorium, protactinium, uranium and the first eleven. This second edition has been completely restructured and rewritten to incorporate current research in all areas of actinide chemistry and chemical physics. The descriptions of each element include accounts of their history, separation, metallurgy, solid-state chemistry, solution chemistry, thermo-dynamics and kinetics. Additionally, separate chapters on spectroscopy, magnetochemistry, thermodynamics, solids, the metallic state, complex ions and organometallic compounds emphasize the comparative chemistry and unique properties of the actinide series of elements. Comprehensive lists of properties of all actinide compounds and ions in solution are given, and there are special sections on such topics as biochemistry, superconductivity, radioisotope safety, and waste management, as well as discussion of the transactinides and future elements.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 9877

9625 (AD-A—172429/3/XAB) Fuels combustion research. Final report, 1 March 1982-30 September 1985. Dryer, F.L.; Glassman; Williams, F.A. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). 9 Dec 1985. 42p. (MAE—1731). NTIS, PC A03/MF A01.

The qualitative mechanisms for the oxidation of benzene and alkylated benzenes corresponds well with flow-reactor results. Major results were obtained on how the aromatic sidechain reacts, and specific fundamental reaction rate data were obtained. A fundamental correlation with respect to fuel C-C bonds for the sooting tendency of fuels under premixed combustion conditions was developed and the concept that fuel structure plays no direct role in determining the critical sooting equivalence ratio was put forth and substantiated by results on pure fuels and fuel mixtures. Fuel-structure and pyrolysis mechanisms were found to be the important controlling factors in sooting diffusion flames. From a knowledge of basic pyrolysis studies, it is now possible to predict a fuel's synergistic trends with diffusion-flame sooting trends; however, these trends may be due to the structural aspects of these flames. Experimental and theoretical research efforts on high-energy-density slurry propellants are reported. Transient internal heat conduction and liquid surface regression of a rigid slurry droplet during liquid vaporization and combustion were investigated using singular perturbation methods. Experimentally, a technique to produce isolated slurry fuel droplets of boron and JP-10 was developed, and observations on the isolated droplet combustion characteristics of several commercially prepared boron/JP-10 slurries were made.

9626 (DOE/ER/04650—T3) **Research in nonlinear problems of energy: Final technical report.** Matkowsky, B.J. (Northwestern Univ., Evanston, IL (USA)). Dec 1986. Contract AC02-78ER04650. 31p. NTIS, PC A03. File Number DE87003374.

We carry out a research program with primary emphasis on the applications of Bifurcation and Stability Theory Problems of energy, with specific emphasis on Problems of Combustion Flame Propagation. In particular we consider the problem of transition from laminar to turbulent flame propagation. A total of ninety-six papers citing this project have been prepared for publication in technical journals. A list of papers and a brief summary of the results contained therein, complete this report.

9627 (LBL—20871) **Ignition by excimer laser photolysis of ozone.** Lucas, D.; Dunn-Rankin, D.; Hom, K.; Brown, N.J. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 36p. (CONF-8610180—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001887.

From Fall meeting of the Western States Section/Combustion Institute; Tucson, AZ, USA (27 Oct 1986).

We have ignited mixtures of hydrogen, oxygen, and ozone in closed cells with 248 nm radiation from a KrF excimer laser. Ozone, the only significant absorber in this system, absorbs a single photon and produces oxygen atoms which initiate combustion. A discretized, time-dependent Beer's law model is used to demonstrate that the radical concentration immediately after photolysis is a function of laser power, ozone concentration, focal length, and separation between the lens and reaction cell. Spark schileren photographs are used to visualize the ignition events and identify the ignition sites. The effects of equivalence ratio, pressure, and the initial gas temperature on the minimum ozone concentration needed to produce ignition are presented, and only the initial temperature has a significant effect. Modelling studies of the ignition process aid in the interpretation of the experimental results, and show that the ignition we observe is not due solely to thermal effects, but is strongly dependent on the number and type of radicals present initially after photolysis. Ignition using other hydocarbons as fuels was also demonstrated. 30 refs., 9 figs. 2 tabs.

9628 (N—86-33025) **Effect of thermal expansion on the stability of two-reactant flames.** Jackson, T.L. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Aug 1986. 14p. (NASA-CR—178168; ICASE—86-56; NAS—1.26:178168). NTIS HC A02/MF A01.

The full problem of flame stability for the two-reactant model, which takes into account thermal expansion effects for all disturbance wave lengths, is examined. It is found that the stability problem for the class of two-reactant flames is equivalent to the stability problem for the class of one-reactant flames with an appropriate interpretation of Lewis numbers.

42 ENGINEERING

REFER ALSO TO CITATION(S) 10659

9629 (SAND—86-1136) **Manufacturing networks.** Hulme, B.L. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 29p. (TTC—0663). NTIS, PC A03/MF A01; GPO Dep. File Number DE87003282.

In this report a way to model manufacturing systems by means of flows in a network is developed. After the network model is described, a theory and algorithm for maximum flows is presented. The maximum flow algorithm is then used repeatedly to compute critical downtimes for every arc (process step) in the network. The principal theoretical result is that the maxflow-mincut theorem of classical network theory holds for manufacturing networks. 1 ref., 2 figs., 3 tabs.

9630 (SAND—86-1341C) **Tracking and classification of objects moving along a known path in an outdoor environment.** Donohoe, G.W.; Hush, D.R.; Fogler, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 5p. (CONF-861190—1). NTIS, PC A02. File Number DE87002700.

From Conference on signals, systems and computers; Pacific Grove, CA, USA (11 Nov 1986).

This paper describes a method for tracking and classifying objects which are moving along a known path in an outdoor environment (e.g., cars along a road). The input is a continuous sequence of video frames. Only the portion of the image which lies along the known path is processed, resulting in a significant reduction in the computational requirements of the algorithm.

9631 (UCRL—52000-86-10) **Energy and technology review: Engineering modeling.** Cabayan, H.S.; Goudreau, G.L.; Ziolkowski, R.W.; Adye, P.; Clements, W.; Crawford, R.B.; de Vore, L.; Hendry, D.P.; Kirvel, R.D.; O'Neal, E.M. (eds.). (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003090.

This report presents information concerning: Modeling Canonical Problems in Electromagnetic Coupling Through Apertures; Finite-Element Codes for Computing Electrostatic Fields; Finite-Element Modeling of Electromagnetic Phenomena; Modeling Microwave-Pulse Compression in a Resonant Cavity; Lagrangian Finite-Element Analysis of Penetration Mechanics; Crashworthiness Engineering; Computer Modeling of Metal-Forming Processes; Thermal-Mechanical Modeling of Tungsten Arc Welding; Modeling Air Breakdown Induced by Electromagnetic Fields; Iterative Techniques for Solving Boltzmann's Equations for p-Type Semiconductors; Semiconductor Modeling; and Improved Numerical-Solution Techniques in Large-Scale Stress Analysis.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 8878, 8883, 8959, 9418, 9791, 9791, 10440, 10547

9632 (EPRI-EL—4910) **300-MVA superconducting generator documentation: Heat transfer to helium fluid under high-speed rotation: Final report.** Eckels, P.W.; Litz, D.C.; Parker, J.H. (Westinghouse Electric Corp., Orlando, FL (USA). Steam Turbine Generator Div.). Nov 1986. 83p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920122.

Although this research on the design of a 300-MVA superconducting generator ended prematurely, the work contributed significantly toward an understanding of the heat transfer characteristics of liquid helium in a high-speed rotational environment. Such information is essential to designing the cooling system for the superconducting rotor windings.

9633 (FRNC-TH—2268) **Contribution to magnetic refrigeration study at liquid helium study.** Lacaze, A. (Grenoble-1 Univ., 38 (France); Institut National Polytechnique, 38 - Grenoble (France)). Oct 1985. 177p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE87750751.

An experimental prototype of magnetic refrigerator operates, following a Carnot cycle, with gallium gadolinium garnet, from liquid helium at 4.2°K. Analysis of the cyle and heat exchanges allowed to improve performance up to get more than 50% of Carnot yield at 1.8°K and nearly 80% at 2.1°K. Operation conditions of a regenerator refrigerator between 4 and 20°K are studied. The association of a magnetic refrigerator and a gas refrigerator is analyzed. Among different ways to realize the magnetic stage, an active regenerator cycle is chosen. An experimental device is described.

9634 (GAT-T—3394) **Fairchild 7A compressor model.** Foster, R.E. (Goodyear Atomic Corp., Piketon, OH (USA). Technical Div.). 23 Sep 1986. Contract AC05-76OR00001. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002203.

The Fairchild 7A centrifugal compressor used in the X-326 isotopic "top" cascade at the Portsmouth Gaseous Diffusion Plant has been modeled using a proprietary computer code called COMPAL by Concepts E.T.I., Inc. of Norwich, VT. The 7A compressor is described and the results of the modeling calculations are presented. Performance characteristics curves (PR vs. flow) are included for various mixtures of UF$_6$ and N$_2$ gases.

9635 (IAEA-TECDOC—375, pp 47-60) **Evaluation of the safety margins for the resistance of radioactive material transport containers during a fire of long duration.** Ringot, C.; Gilles, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92, France). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

This is a progress report on the work carried out by the Commissariat a l'Energie Atomique, sponsored by the Institut de Protection et de Surete Nucleaire, on the evaluation of safety margins of certain types of containers under fire environment accident conditions. Four different assessments of Type B packagings have been performed as follows: 1) An 800 deg. C fire test was performed on the SV16, a small flask used for transporting Co-60 sources. The flask had previously been crushed and pierced at four points. 2) Thermal analyses of an IL46 flask, used for transporting irradiated fuel elements, were performed for various package configurations and fire durations. 3) The thermal response of a TN-12 irradiated fuel flask, developed in France by TRANSNUCLEAIRE, was analyzed for fire exposures of 30, 60 and 90 minutes duration. 4) The French container FS47, used for the transport of plutonium oxide (PuO$_2$) was analyzed for fire exposures of 30, 60 and 90 minute duration and fire temperatures ranging from 800 deg. C to 1000 deg. C. In addition, assessments of two packagings not designed specifically to withstand accident conditions have also been made. The report briefly summarizes the results from these separate investigations. 3 refs, 4 figs, 2 tabs.

9636 (MLM-MU—86-71-0001) **Reel-to-reel tackdown machine and die cutting.** Brannaman, R.L. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 21 Nov 1986. Contract AC04-76DP00053. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002960.

A circuit tackdown station was developed to align and tack up to five separate layers that make up a detonator cable assembly before the assembly is fed into a laminating press for final processing. To aid in material handling, the separate layers are punched on a 35-mm wide, 250-ft long format and match the printed circuit progression. This machine has proven to be flexible in tooling and programming while minimizing material handling. In the future, automated die cutting at Mound may be feasible.

9637 (N—86-31649) **Evaluation of a hybrid hydrostatic bearing for cryogenic turbopump application.** Spica, P.W.; Hannum, N.P.; Meyer, S.D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 19p. (NASA-TM—87255; E—2945; NAS—1.15:87255). NTIS HC A02/MF A01.

A hybrid hydrostatic bearing was designed to operate in liquid hydrogen at speeds to 80,000 rpm and radial loads to 440 n (100 lbf). The bearing assembly consisted of a pair of 20-mm angular-contact ball bearings encased in a journal, which was in turn supported by a fluid film of liquid hydrogen. The size and operating conditions of the bearing were selected to be compatible with the operating requirements of an advanced technology turbopump. Several test parameters were varied to characterize the bearing's steady-state operation. The rotation of the tester shaft was varied between 0 and 80,000 rpm. Bearing inlet fluid pressure was varied between 2.07 and 4.48 MPa (300 and 650 psia), while the fluid sump pressure was independently varied between 0.34 and 2.07 MPa (50 and 300 psia). The maximum radial load applied to the bearing was 440 N (110 lbf). Measured hybrid-hydrostatic-bearing stiffness was 1.5 times greater than predicted, while the fluid flow rate through the bearing was 35 to 65 percent less than predicted. Under two-phase fluid conditions, the stiffness was even greater and the flow rate was less. The optimal pressure ratio for the bearing should be between 0.2 and 0.55 depending on the balance desired between bearing efficiency and stiffness. Startup and shutdown cyclic tests were conducted to demonstrate the ability of the hybrid-hydrostatic-bearing assembly to survive at least a 300-firing-duty cycle. For a typical cycle, the shaft was accelerated to 50,000 rpm in 1.8 sec. The bearing operated for 337 start-stop cycles without failure.

9638 (N—86-31890) **Liquid helium pumps for in-orbit transfer.** Kittel, P. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Apr 1986. 36p. (NASA-TM—88239; A—86201; NAS—1.15:88239). NTIS HC A03/MF A01.

Both mechanical and fountain-effect pumps are being considered for use in the in-orbit resupply of superfluid helium to a number of scientific instrument systems. This paper presents a review of the operating characteristics of these pumps. Particular emphasis will be given to the different methods of evaluating the efficiency of these pumps and their effectiveness in a transfer system.

9639 (NP—7770036) **Characteristic values of dynamic secondary speed controlled axial piston units.** Metzner, F.T. (Hochschule der Bundeswehr, Hamburg (Germany, F.R.). Fachbereich Maschinenbau). 13 Dec 1985. 188p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87770036.

The basic principle of secondary speed regulation is first explained. The effect on the torque of the secondary unit due to the adjustment of its angle of movement relative to the deviation between the reference and actual speed is stated, which is revolutionary for hydrostatic drive technology. There is then a short survey of some different signal processing concepts which are possible in principle, for the control circuit, and a report on the state of technology. The formation of a replacement model of a standard mass-produced axial piston unit (control circuit, adjusting device, control range) and the calculation process are then dealt with, as well as the construction of the test rig and the instrumentation cost. The results of calculations and measurements are submitted for hydraulic signal processing and characteristics for achieving transition processes free of harmonics. (HWJ).

9640 (SAND—86-1820) **Dynamics of gas-actuated pipe closures.** Bennett, M.D.; Weydert, J.C. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003279.

The translational motion of a massive, sliding gate impelled by a high-pressure gas is numerically modeled. The working fluid - a mixture of the reservoir gas and the detonation products from the explosive charge that cuts the vessel walls - is taken to be a real gas in thermodynamic equilibrium. Based on the measured actuation time of the 12-nitrogen-driven pipe closures used during the past 8 years in underground nuclear blast events at the Neveda Test Site, the maximum error in the model is found to be 5%. The modeling shows a crossover point when we compare the performance of different reservoir gases. In the case of supply pressures below a few hundred atm ospheres, nitrogen delivers more energy to the gate than does helium. However, helium at 1000 atm results in an estimated 21% reduction in the closing time. With helium, the relative gate response continues to improve as the pressure is further increased.

9641 (UCID—20936) The high field superconducting magnet program at LLNL: Annual report. Miller, J.R.; Chaplin, M.R.; Kerns, J.A.; Leber, R.L.; Rosdahl, A.R.; Slack, D.S.; Summers, L.T.; Zbasnik, J.P. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1986. Contract W-7405-ENG-48. 48p. NTIS, PC A03/A01; 1; GPO Dep. File Number DE87003608.

In FY 86 the program continued along several interrelated thrust areas. These thrust areas have been broadly labeled as follows: (1) Superconductor Research and Technology; (2) Magnet Systems Materials Technology; (3) Magnet Systems Design Technology; (4) High Field Test Facility; and (5) Technology Transfer.

9642 (UCRL—95314) Design of externally pressurized gas bearings for stiffness and damping. Roblee, J.W.; Mote, C.D. Jr. (Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley (USA)). 5 Sep 1986. Contract W-7405-ENG-48. 34p. (CONF-8609197—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002381.

From 9. international gas bearing symposium; Washington, DC, USA (8 Sep 1986).

A design method for flat, circular thrust bearings is presented in this paper. The design method is based upon a new dynamic model of the bearing and permits the selection of stiffness and damping for applications of bearings in vibrating environments. Application of the design method to the tuning of bearing dynamics is emphasized here, while the development of the dynamic model is discussed in other references. Design constraints are considered in the iterative design procedure and are illustrated in a bearing design example.

9643 (UNI—4091) UNC ice vest testing. Bartley, P.L. (UNC Nuclear Industries, Inc., Richland, WA (USA)). 4 Sep 1986. Contract AC06-76RL01857. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002686.

The Barrir Wear Ice Vest (Barrier Vest) was tested at UNC from June 6, 1986 to June 24, 1986. The test was very successful with 27 of the 29 test responses indicating a safer work environment and a desire to wear the vest again.

9644 Investigation of plasma armature voltage gradients using a static discharge. Parker, J.V. (Los Alamos National Lab., Los Alamos, NM 87545). pp 66 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—).

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

This paper describes a technique for obtaining voltage scaling parameters by measuring the plasma voltage on small-scale, static discharges. Validity of the static arc measurement is demonstrated by comparing the static arc voltage gradient for copper/G-10 with the muzzle voltages measured on various EML devices with bore diameters ranging from 1 to 10 cm. The experimental discharge chamber resembles a conventional, bolt-together railgun device with a length of 30 cm. The muzzle end is blocked and sealed to contain the plasma pressure. The discharge channel width is 6.35 mm and the discharge height is variable from 6.35 to 25.4 mm in increments of 6.35 mm. Rail width is varied with discharge height to maintain the plasma pressure constant at fixed current. The breech end is open to provide venting of arc ablation products. Both the rail and insulator surface are provided with thin replaceable liners to facilitate rapid clean-up after each test. Careful attention to tolerances combined with polyethylene gaskets and large bolting force are required to provide leak-tight operation. A series of tests has been performed using the most common railgun materials, copper electrodes and G-10 fiberglass insulation. The test current had a peak value of 145 kA (23 kA/mm) and a quarter cycle discharge time of 220 μs. The plasma voltage was measured at the muzzle end using a shunt resistance and a current transformer.

4203 Lasers

REFER ALSO TO CITATION(S) 9046, 9743, 9762, 10166, 10470, 10612

9645 (DOE/ER/52125—3) Design of a carbon dioxide laser heated TLD reader. Abhold, M.E. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 1986. Contract FG06-86ER52125. 38p. (CONF-860806—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003138.

From 8. international conference on solid state dosimetry; Oxford, UK (26 Aug 1986).

Conventional TLD readers suffer irreproducible heating rates from variable thermal contact between the crystal and the heated surface. A microprocessor controlled CO_2 laser heated TLD reader has been designed and constructed to minimize variations in the heating rate, and to provide a more uniform spatial heating rate. The reader employs a power stabilization circuit comprised of both laser head temperature stabilization and calorimetric power feedback stabilization. The control software is able to distinguish between transverse modes and allows heating only when the laser is operating in the TEM_{00} mode. The data-acquisition is accomplished by a IBM-PC compatible computer coupled to a analog to digital convertor. The reader has been used in investigations of LiF TLD glow-curve analysis with an emphasis on the emission light spectrum. The design of the reader and the knowledge gained from operating experience is presented.

9646 (N—86-32717) Theoretical studies of resonance enhanced stimulated raman scattering (RESRS) of frequency doubled Alexandrite laser wavelengths in cesium vapor. Progress report. Lawandy, N.M. (Brown Univ., Providence, RI (USA)). Oct 1986. 16p. (NASA-CR—179768; NAS—1.26:179768). NTIS HC A02/MF A01.

This work focused on understanding the effects of arbitrary transverse and longitudinal relaxation rates on the susceptibilities of coherently driven three-level systems. The approximation of a single relaxation rate often made in previous work is strongly invalidated by the variation in the spontaneous emission lifetime between various atomic level pairs in systems such as cesium. It is of great importance to the problem of nonlinear infrared generation to determine the dependence of both real and imaginary susceptibility on relaxation rates. The imaginary susceptibility on the pump transition determines the absorption of pump photons and the imaginary susceptibility on the laser transition determines the spectral dependence of the gain. This is of particular importance for pure Raman emission (i.e., absorption at linecenter of the gain transition) as it determines the tunability characteristics we are aiming to predict. The real susceptibility is important when cavities are used at the signal field as this will determine the loaded resonance of the Raman oscillator. Researchers show that in some cases which result from having different relaxation rates mode splitting may result, allowing more than one frequency to have the same Raman wavelength, possibly resulting in a temporal instability.

9647 (SAND—86-1307C) Laser-induced etching. Ashby, C.I.H. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 8p. (CONF-861038—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003030.

From OSA/APS international laser science conference; Seattle, WA, USA (20 Oct 1986).

Laser-induced etching of metals, semiconductors, and other inorganic materials can be etched by ablation, localized heating to enhance a thermally activated chemical reaction, or photogeneration of a good etchant from a less reactive precursor. In addition, semiconductors can be etched following photoexcitation of the surface to produce free carriers. The advantages and disadvantages of these four approaches to laser-induced etching are reviewed in this paper.

9648 **Review of recent x-ray laser experiment results.** Matthews, D.L. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 92 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors are vigorously continuing research into the design, demonstration, and application of the Nova laser-pumped x-ray laser. Using exploding foil plasma amplifier designs they are pursuing inversion schemes using neon, nickel, and other ionization sequences in an effort to achieve significant single-pass or multipass amplification at wavelengths shorter than 10 nm. The status of measurements of the saturation energies, coherent power, beam divergence, modal purity, and other laser characteristics are repeated. Designs and progress on demonstration of multipass amplifiers are described. Finally, a review is given of the various interesting applications of x-ray lasers having wavelengths in the 3-10-nm regime.

9649 **Demonstration of two-electron (shake-up) photoionization and population inversions in the visible and VUV.** Silfvast, W.T.; Wood, O.R. II; Al-Salameh, D.Y. (AT&T Bell Labs., Holmdel, NJ 07733). pp 92 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The two-electron (shake-up) photoionization process has been shown to be an effective mechanism for producing large population inversions in He/sup +/ with gain at 164 nm and in Ar/sup +/ with gain at 428 and 477 nm and for observing the first autoionizing states in Cd/sup +/. Such a mechanism was recently proposed as an excitation mechanism for a VUV laser in lithium. In each species the rapid excitation and detection using broadband emission from a 30-mJ 100-ps duration laser-produced plasma and a detection system with subnanosecond time resolution were essential in observing these effects. In He, gains of up to 0.8 cm/sup -1/ for durations of 2-4 ns at 164.0 nm on the He-like (n = 3-2) transition in He/sup +/ were measured by comparing the plasma emission from a well-defined volume with and without the presence of a mirror of known reflectivity. The n = 3 upper laser level is pumped not only directly via two-electron photoionization from the neutral ground state but also indirectly (in times of the order of 1-2 ns) via electron collisions from photoionization-pumped higher-lying levels. The decay rate of the photoionization-pumped radiation-trapped lower laser level is increased by a unique process involving absorption of radiation via photoionization of ground state neutral helium atoms.

9650 **Evaluation of LAP and LA/sup chemical bond/P as frequency conversion materials for high-power lasers.** Velsko, S.P.; Eimerl, D. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 84 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

L-arginine phosphate has emerged recently as an interesting new nonlinear material for several reasons. First, this material apparently has a damage threshold about twice that of KDP according to recent tests performed at Lawrence Livermore National Laboratory. Second, phase matched SHG efficiencies from LAP 3-4 times greater than KDP have been previously. Because the individual d tensor couplings were not known, it was not certain that the phase matching direction chosen by those workers was in fact optimum. To better assess the potential of LAP for harmonic generation in high-power laser systems the authors have measured the d coefficients and coherence lengths of LAP using the wedge technique. All the coefficients are found to be larger than d/sub 36/ of KDP. The measured coherence lengths in LAP differ significantly from those calculated by extrapolation of refractive indices measured in the visible. Thus the phase matching curves calculated previously are not correct. The source of error is evidently the modified dispersion in the near-IR caused by overtone absorption bands. By combining the coherence length data with accurate index measurements at visible wavelengths the authors have calculated the correct loci and determined the optimum orientation for phase matching. Because the inherent optical activity of LAP can affect interpretation of the fringe amplitudes observed in the wedge measurements, they have determined the components of the gyration tensor.

9651 **Free-electron lasers.** Brau, C.A. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). pp 24 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The fundamental principles of free-electron lasers are now well understood, and theoretical predictions accurately describe the performance of experimental devices. In their operation, free-electron lasers resemble microwave devices, such as traveling-wave tubes, more closely than they do conventional lasers. The gain medium consists of an electron beam moving at high speed (close to the speed of light) in a magnetic field. The magnetic field is arranged so that the electrons passing through it are deflected alternately left and right. Thus, the electrons execute a wiggly motion through the magnetic field (called the wiggler), and radiate at the frequency of the oscillations. Because of the speed of the electrons, the radiation is Doppler shifter to shorter wavelengths, given by λ/sub L/ ≈ λ/sub W-bar// γ/sup 2/, where λ/sub L/ is the laser wavelength, λ/sub W-bar/ is the wiggler period, and γ is the electron energy in units of the electron rest energy (0.511 MeV). Thus, for a 100-MeV electron (γ = 200) moving through a wiggler with a 2-cm period, the wavelength is 0.5 μm, in the green part of the spectrum. Because of the unique way in which free-electron lasers operate, they offer several advantages relative to conventional lasers. In the first place, they can be tuned to different wavelengths by varying the electron energy, as indicated by Eq. (1). In the second place, they can be operated at extremely high power. In the case of conventional lasers, the power is limited by the rate at which heat can be removed by means of high-speed flow and other techniques. In free-electron lasers, the waste heat resides in the electron beam and exits the optical region at close to the speed of light. Moreover, high-power electron accelerators already exist. Finally, free-electron lasers produce excellent optical-beam quality, close to the diffraction limit.

9652 **Optical properties of Cr/sup 3+/ and Nd/sup 3+/ ions in LaMgAl/sub 11/O/sub 19/.** Shinn, M.D.; Caird, J.A.; Krupke, W.F. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 52-54 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

A new material being evaluated in the Soviet Union and France as a laser host is LaMgAl/sub 11O/19 (LMAO), with thermomechanical properties comparable to YAG and lasing efficiency, in the long pulse mode, that is 20% higher. In addition, estimates of the emission cross section (6.2 X 10/sup -20/ cm/sup 2/) and nonlinear refractive index (n/sub 2//sup 6/ = 2.6 X 10/sup -13/ esu) are within the limits required for fusion lasers. In a preliminary study the LMAO lattice was found to accept Cr/sup 3+/ ions without deleterious segregation effects. Energy transfer from Cr/sup 3+/ to Nd/sup 3+/ ions was also observed, but only an upper limit of the transfer efficiency (eta ≦ 90%) could be made. The authors present results of detailed energy transfer kinetics studies which indicate a total transfer efficiency of ≈40% and model the effect of co-doping on the laser performance.

9653 **Sensitization of Nd/sup 3+/ emission by Sm/sup 2+/ in CaF/sub 2/ and other fluorite-structure hosts.** Payne, S.A.; Chase, L.L. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 54-55 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Trivalent chromium is an efficient sensitizer of Nd/sup 3+/ in several oxide crystal hosts. Since Cr/sup 3+/ cannot be incorporated into many other hosts with the proper crystal field magnitude for Nd/sup 3+/ sensitization, alternative sensitizers would be highly desirable, particularly for fluoride crystals, which have low nonlinear refractive indices. Divalent samarium, which can be incorporated in a number of fluoride hosts, has strong broad absorption bands in the visible and UV, and its red luminescence often overlaps strong Nd absorption lines. The authors have investigated nonradiative energy transfer from Sm/sup 2+/ to Nd/sup 3+/ in CaF/sub 2/ where the crystal field splitting of the 4f/sup 5/5d excited states is large enough that the emitting level is derived largely from this mixed configuration, and the Sm/sup 2+/ luminescence has a large overlap with the Nd/sup 3+/ absorption lines.

9654 Progress toward an rf-linac free-electron laser for the extreme UV spectral region. Newnam, B.E.; McVey, B.D.; Goldstein, J.C.; Elliott, C.J.; Schmitt, M.J.; Lee, K.; Wang, T.S.; Carlsten, B.; Fraser, J.S.; Sheffield, R.L. (Los Alamos National Lab., Los Alamos, NM 87545). pp 144-145 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Los Alamos National Laboratory is pursuing a research and development program leading to eventual establishment of a free-electron laser (FEL) facility, based on a single rf linear accelerator, for production of coherent radiation extending from the visible spectrum to the extreme UV and soft x-ray wavelengths as short as 10 nm. Several key areas have been identified for concentrated attention over the next two years, particularly to assure feasibility at the short-wave-length end of this range. First, theoretical studies are directed toward maximizing the single-pass gain and output power from FEL oscillators using realistic electron beams produced by rf linacs. Since electron-beam emittance is the primary concern for rf linacs, a unique 3-D code (FELEX) has been developed for numerical simulation of FEL parameter variations. Accelerator calculations of the influence of single-bunch beam loading on longitudinal energy spread are being performed with an advanced version of PARMELA. Also, to project further into the extreme UV and soft x-ray regions, methods to maximize the conversion efficiency to coherent optical harmonics of the fundamental lasing wavelength are being evaluated.

9655 Theory and design studies for an rf-linac-driven free-electron laser for the extreme UV. McVey, B.D.; Elliott, C.J.; Goldstein, J.C.; Lee, K.; Newnam, B.E.; Schmitt, M.J. (Los Alamos National Lab., Los Alamos, NM 87545). pp 142-143 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The theoretical design of a free-electron laser (FEL) oscillator configuration operating in the extreme UV spectral region (1000-100 A) is described. The FEL is assumed to be driven by an electron beam from an rf linear accelerator. Since the small signal gain decreases with optical wavelength, and high gains (≈ 4) are required due to lower mirror reflectivity, the major emphasis on the authors' design studies is to determine the electron-beam quality necessary to operation. The measure of electron-beam quality are values for the current, the transverse emittance, and energy spread. Initial simulation results indicate that an electron beam with the following parameters is required: $I \leqq 100$A; ε/sub n/ (normalized emittance) $\geqq 20\pi$; and $\Delta\gamma/\gamma \geqq 0.25\%$. The present FEL experiment at Los Alamos has exceeded the required current with $\approx$3-4 times larger values for the normalized emittance and energy spread. Improvements in the emittance and energy spread are expected with development of the photocathode injector.

9656 Review of free-electron laser progress. Pellegrini, C. (Brookhaven National Lab., Upton, NY 11973). pp 136 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors review the most recent experimental and theoretical results in the field of free-electron lasers in a wavelength range going from the visible to the millimeter region.

9657 Physics issues in the design of a high extraction efficiency wiggler for a free-electron laser oscillator. Takeda, H.; Goldstein, J.C.; Lee, K.; McVey, B.D.; Warren, R.W. (Los Alamos National Lab., Los Alamos, NM 87545). pp 130 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

A number of physics issues are relevant to the design of a high extraction efficiency wiggler for a free-electron laser (FEL) oscillator. The physics issues the authors' address here are the following: (1) the balance of small-signal gain with maximum extraction efficiency when the wiggler length is constrained; (2) degradation of the electron extraction efficiency with the onset of the sideband instability and the use of corrective frequency filtering techniques to suppress the sideband; (3) reduction of efficiency due to the structure of the electron micropulse and that due to cavity length detuning; and (4) 3-D effects such as electron-beam emittance, focusing and refractive effects, misalignments, and the self-consistent FEL resonator solution with the electron beam present. The authors have developed several numerical models with increasing complexity to isolate and address the above physics issues.

9658 Seeding stimulated Brillouin scattering with a pump laser. Watkins, D.E.; Kurnit, N.A.; Fisher, R.A.; Loree, T.R. (Los Alamos National Lab., Chemistry Div., Los Alamos, NM 87545). pp 122-123 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors have found that stimulated Brillouin scattering (SBS) can be seeded by the pump laser; that is, SBS can be brought from below to above threshold by introducing backward-going XeCl laser light with a bandwidth exceeding the Brillouin frequency shift. While they have only demonstrated amplitude control as yet, the seeding process should also affect the phase of the scattered beam and the fidelity of the phase conjugation. The authors have taken some initial steps toward addressing the latter issue. The demonstration of amplitude control was straightforward. The SBS of an XeCl laser beam in an SF/sub 6/ cell was measured with and without a counterpropagating seed beam, which was a small fraction split from the pump beam. Their injection-locked XeCl laser produced up to 300 mJ of 308-nm radiation with a bandwidth of 0.2 cm/sup -1/. This pump beam was focused (focal lengths from 20 to 100 cm) into a cylindrical optical cell containing 18 atm of SF/sub 6/. The seed beam was aligned on the same axis and focused (10-cm focal length)$\approx$1 cm behind the pump focal spot, so that it overlapped completely the pump focal volume. With the pump just below threshold for unaided SBS, a seed with as little as 10/sup -4/ of the pump energy induced the scattering producing a reflectivity of 10%. This reflected energy was a factor of 200 larger than the backward-going light in the unseeded case.

9659 Optimizing sum frequency mixing in Hg. Smith, A.V.; Alford, W.J. (Sandia National Labs., Albuquerque, NM 87185). pp 122 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Using techniques the authors have developed, they recently measured the matrix elements of atomic Hg for the transitions 6/

sup 1/S, 7/sup 1/S-n/sup 1,3/P, 6p'/sup 1/P(n = 6-13) with high accuracy. These results allow one to calculate the index matching characteristics for any sum frequency mixing process for wavelengths down to 120 nm. They also are sufficient for calculation of nonlinear susceptibilities for third-order mixing when the 7/sup 1/S level is two-photon resonant. These results indicate that conversion efficiencies much greater than those demonstrated to date should be possible. A comparison of calculated and measured efficiencies is made.

9660 **Ozone: An effective and scalable saturable absorber for KrF lasers.** Thomas, S.J.; Bigio, I.J. (Los Alamos National Lab., Los Alamos, NM 87545). pp 62-64 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors report the first documentation of an effective scalable saturable absorber for KrF lasers. Their measurements show that a 4-cm path length of ozone (O/sub 3/) at a partial pressure of 0.4 Torr will attenuate energy densities under 50 mJ/cm/sup 2/ by a factor of ≈ 50 while allowing transmission of 90% of fluences above 1 J/cm/sup 2/.

9661 **Spontaneous and stimulated emission from quasi-free particles.** Friedman, A.; Gover, A.; Kuritzki, G.; Ruschin, S.; Yariv, A. (Brookhaven National Lab., National Synchrotron Light Source Dept., Upton, NY 11973). pp 180-181 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

A general formalism was developed for analyzing the spontaneous and stimulated emission of radiation in a variety of electron radiation effects and devices. This formulation was applied to derive explicit expressions for spontaneous emission radiant intensity and stimulated emission gain in the quantum mechanical and classical limits. The radiation schemes which are considered fall into three categories: (1) slow wave radiators: e.g., Cherenkov radiation; (2) bremsstrahlung radiators: e.g., magnetic bremsstrahlung free-electron laser (FEL); and (3) transverse confinement radiators: e.g., cyclotron resonance maser and channeling radiation. In all these schemes, the common feature is that the interaction between the electron and the radiation field is along a long interaction length. This dictates a condition of longitudinal momentum conservation together with the requirement of energy conservation. This common feature brings about similar spontaneous and stimulated emission line functions to all the radiation schemes which are controlled by either a homogeneous or inhomogeneous broadening mechanism.

9662 **Los Alamos free-electron laser experiment: Current status.** Feldman, D.W.; Warren, R.W.; Newnam, B.E.; Lumpkin, A.H.; Stein, W.E.; Lynch, M.T.; Lohsen, R.; Young, L.M.; McVey, B.D.; Goldstein, J.C.; Takeda, H. (Los Alamos National Lab., Los Alamos, NM 87545). pp 180 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

This paper covers the current status of the laser and energy-recovery experiments and discusses the various physics measurements that the authors plan to carry out during this phase of their program.

9663 **Radially resolved simulation of a high-gain free electron laser amplifier.** Fawley, W.M.; Prosnitz, D.; Doss, S.; Gelinas, R. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, Livermore, CA 94550). pp 212-217 of Free-electron generators of coherent radiation. Brau, C.A.; Jacobs, S.F.; Scully, M.O. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1984). (CONF-830693—). Contract W-7405-ENG-48.

From Society of Photo-Optical Instrumentation Engineers conference; Bellingham, WA, USA (26 Jun 1983).

The results of a two-dimensional simulation of a high-gain free electron laser (FEL) amplifier is presented. The simulation solves the inhomogeneous paraxial wave equation. The source term is radially resolved and is obtained by tracking the interaction of the laser field with localized macroparticles.

9664 **Beam-breakup calculations for the Los Alamos free-electron laser (FEL) linac.** Cooper, R.K. (Los Alamos National Lab., AT-6, MS H829, Los Alamos, NM 87545). pp 156-159 of Free-electron generators of coherent radiation. Brau, C.A.; Jacobs, S.F.; Scully, M.O. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1984). (CONF-830693—).

From Society of Photo-Optical Instrumentation Engineers conference; Bellingham, WA, USA (26 Jun 1983).

In addition to the usual circularly symmetric TM/sub 010/ mode used to accelerate particles in an rf linac, there is a large number of modes with cos phi or sin phi dependence, for example the TM/sub 1xx/ modes. These latter modes possess a uniform magnetic (dipole) field near the axis of symmetry and therefore can deflect the beam away from the axis. Any portion of an accelerated beam that is off-axis will drive these modes, so that subsequent portions of the beam will be deflected. This deflected beam will then resonantly drive the same modes in downstream cavities, so that still later portions of the beam will be more severely deflected, and so on. In this paper are reported the results of numerical simulations of this so-called cumulative beam-breakup instability. The simulation assumes that only the TM/sub 110/ mode acts to deflect the beam, and further assumes that this mode does not couple from one accelerating cavity to the next.

9665 **Electron beam diagnostics for the Los Alamos free-electron laser oscillator experiment.** Sheffield, R.L.; Stein, W.E.; Lumpkin, A.; Warren, R.W.; Fraser, J.S. (Los Alamos National Lab., AT-7, MS H825, Los Alamos, NM 87545). pp 151-155 of Free-electron generators of coherent radiation. Brau, C.A.; Jacobs, S.F.; Scully, M.O. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1984). (CONF-830693—).

From Society of Photo-Optical Instrumentation Engineers conference; Bellingham, WA, USA (26 Jun 1983).

Electron beam diagnostics for the Los Alamos free-electron laser oscillator experiment have been designed to measure the time dependence of the electron energy distribution with time intervals ranging from 30 ps to 200 μs. The electron beam consists of macropulses that have a 100 μs duration and a 1 Hz repetition rate. Each macropulse consists of a series of micropulses that have ≈ 30 ps duration, ≈ 50 A peak current, and ≈ 50 ns separation. The primary purposes of the electron beam diagnostics is twofold: (1) optimization of the bunching system to provide a maximum peak current in the micropulses and (2) measurement of the time dependence of the electron energy distribution during build-up of the photon field in the oscillator. Because the exact time of build-up is uncertain, provisions have been made to allow the observation window to be varied from 10 to 100 μs and to be delayed by times up to 100 μs.

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REFER ALSO TO CITATION(S) 8866, 9088, 9202, 10499, 10648

9666 **(AECL—8752) SPORTS (version 1) User's Guide.** Chatoorgoon, V.; Thibeault, P.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jun 1985. 51p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87700276.

SPORTS is a transient one-dimensional thermalhydraulic code formulated from the non-linear time dependent conservation equations and designed to investigate two-phase flow stability. The SPORTS Users' Guide contains some features of the code, a brief description of the program environment and access, and a description of the input data complete with a sample problem.

9667 (FRNC-TH—2300) Temperature profiles in a steam-liquid sodium jet. Application to wastage. Park, K.H. (Poitiers Univ., 86 (France)). Dec 1983. 116p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750725.

The first part of this work presents a certain number of recalls concerning wastage, jets, sonic jets, turbulent jets reactive or not. The aim of this thesis is to group the theoretical formulas concerning gaseous jets in liquids, to determine from experiments the temperature distributions inside the reactive jet, and to establish correlations between the theory and the experiments carried out to obtain a model representative of the temperature distribution in steam jets into liquid sodium. The theoretical development is presented (differential and integral approaches), as also the experiments (JONAS) developed to determine the temperature distribution. The field of validity of experiments and approximations is then defined in view of application to wastage.

9668 (K/CSD/TM—65) Calculation of melting and homogenization of UF$_6$ inside product cylinders. Kirkpatrick, J.R. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Nov 1986. Contract AC05-84OT21400. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003591.

A method is presented for calculating heat transfer to the liquid inside a horizontal cylinder which is being heated and for calculating the temperatures in the liquid as functions of both time and location. Heat transfer is modeled using a quasi-one dimensional approach based on a classical integral boundary layer analysis for free convection. The internal flow is modeled assuming that the bulk liquid is composed of horizontal strata of constant temperature. The method is intended to give approximate results without going to the expense of a full finite difference calculation.

9669 (KFK—4091) Time averaging procedure for calculating the mass and energy transfer rates in adiabatic two phase flow. Boccaccini, L.V. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jul 1986. 61p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87750314.

To take advantages of the semi-implicit computer models - to solve the two phase flow differential system - a proper averaging procedure is also needed for the source terms. In fact, in some cases, the correlations normally used for the source terms - not time averaged - fail using the theoretical time step that arises from the linear stability analysis used on the right handside. Such a time averaging procedure is developed with reference to the bubbly flow regime. Moreover, the concept of mass that must be exchanged to reach equilibrium from a non-equilibrium state is introduced to limit the mass transfer during a time step. Finally some practical calculations are performed to compare the different correlations for the average mass transfer rate developed in this work.

9670 (KFK—4122) Benard convection in a partly solidified two-component system. Zimmermann, G.; Mueller, U.; Davis, S.H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Aug 1986. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750315.

A horizontal layer is heated from below and cooled from above so that the enclosed two-component liquid is solidified in the upper part of the layer. Davis, Mueller and Dietsche (1984) examined the case of a single component liquid in which transport occurs via thermal diffusion and convection. In the present case there is the addition effect of thermosoluted convection including the Soret effect. For reasons of simplicity it is assumed that the solute is completely rejected from the phase and the solid-liquid surface free energy is negligible. We use linear theory to study the stability of the steady temperature and concentration profile in a two-layer system, a liquid and a solid layer. In the absence of phase change, the Soret effect gives rise to an oscillatory onset of convection as shown e.g. by Hurle and Jakeman (1971). In the present work Soret convection with phase change is studied to determine the influence of the thickness of the solid layer, the effect the latent heat of solidification and the initial concentration on the stability of the system and the oscillation frequency of the convection.

9671 (N—86-31652) Analysis of the gas particle radiator (GPR). Chubb, D.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jul 1986. 35p. (NASA-TM—88786; E—2639-1; NAS—1.15:88786). NTIS HC A03/MF A01.

The theoretical performance of a new space radiator concept, the gas particle radiator (GPR), is calculated. The GPR uses a gas containing emitting, submicron particles as the radiating media. A transparent window contains the gas particle mixture around the solid radiator emitting surface. A major advantage of the GPR is that large emissivity (e sub T is greater than or = 0.8) is achieved without the use of emissive coatings. A radiation heat transfer analysis shows that for a modest volume fraction (approx. 10(-4)) of submicron particles and gas thickness (approx. 1 cm) the emissivity, e sub T, is limited by the window transmittance. Besides determining the emissivity, the window is the critical element for making it possible for the GPR to have lower mass than a tube type radiator. The window acts as a bumper to provide meteoroid protection for the radiator wall. The GPR was compared to a proposed titanium wall, potassium heat pipe radiator. For both radiators operating at a power level of 1.01 MW at 775 K it was calculated that the GPR mass was 31 percent lower than the heat pipe radiator.

9672 (N—86-31826) Modeling of zero gravity venting: studies of two-phase heat transfer under reduced gravity. Final Report. Merte, H. Jr. (Michigan Univ., Ann Arbor (USA)). Aug 1986. 66p. (NASA-CR—179662; NAS—1.26:179662). NTIS HC A04/MF A01.

The objective is to predict the pressure response of a saturated liquid-vapor system when undergoing a venting or depressurization process in zero gravity at low vent rates. An experimental investigation of the venting of cylindrical containers partially filled with initially saturated liquids was previouly conducted under zero-gravity conditions and compared with an analytical model which incorporated the effect of interfacial mass transfer on the ullage pressure response during venting. A new model is presented to improve the estimation of the interfacial mass transfer. Duhammel's superposition integral is incorporated to approximate the transient temperature response of the interface, treating the liquid as a semi-infinite solid with conduction heat transfer. Account is also taken of the condensation taking place within the bulk of a saturated vapor as isentropic expansion takes place. Computational results are presented for the venting of R-11 from a given vessel and initial state for five different venting rates over a period of three seconds, and compared to prior NASA experiments. An improvement in the prediction of the final pressure takes place, but is still considerably below the measurements.

9673 (N—86-33043) Supercomputer implementation of finite element algorithms for high speed compressible flows. Progress report, period ending 30 June 1986. Thornton, E.A.; Ramakrishnan, R. (Old Dominion Univ., Norfolk, VA (USA)). Jun 1986. 170p. (NASA-CR—177065; NAS—1.26:177065). NTIS HC A08/MF A01.

Prediction of compressible flow phenomena using the finite element method is of recent origin and considerable interest. Two shock capturing finite element formulations for high speed compressible flows are described. A Taylor-Galerkin formulation uses a Taylor series expansion in time coupled with a Galerkin weighted residual statement. The Taylor-Galerkin algorithms use explicit artificial dissipation, and the performance of three dissipation models are compared. A Petrov-Galerkin algorithm has as its basis the concepts of streamline upwinding. Vectorization strategies are developed to implement the finite element formulations on the NASA Langley VPS-32. The vectorization scheme results in finite element programs that use vectors of length of the order of the number of nodes or elements. The use of the vectorization procedure speeds up processing rates by over two orders of magnitude. The Taylor-Galerkin and Petrov-Galerkin algorithms are evaluated for 2D inviscid flows on criteria such as solution accuracy, shock resolution, computational speed and storage requirements. The convergence rates for both algorithms are enhanced by local time-stepping schemes. Extension of the vectorization procedure for predicting 2D viscous and 3D inviscid flows are demonstrated. Conclusions are drawn regarding the applicability of the finite element procedures for realistic problems that require hundreds of thousands of nodes.

9674 (UCID—20297-86-3) Granular solids flow project: Quarterly report, July-September 1986. Walton, O.R. (ed.). (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003244.

As a means of gaining a better understanding of the flow behavior of granular solids we have continued our development and utilization of discrete particle computer models that calculate the motion of each individual grain in idealized granular solids. We have conducted further calculations of binary mixtures of spheres of different sizes with our three-dimensional steady shearing model and have made comparisons to various theoretical predictions. We have added coding for real boundaries to our discrete particle models and can soon start preliminary testing of these boundaries in simulating rectilinear Couette flows, channel flows, or inclined chute flows. We have completed verification calculations with a new, more efficient, rigid particle model for smooth inelastic particles and are continuing to add features to that new model. Also, in collaboration with oil-shale project researchers developing new equipment for cooling retorted oil shale, we have conducted a series of gravity flow tests of glass beads and crushed shale through a periodic array of horizontal rods. We plan to utilize the results of those laboratory tests for comparison with future discrete particle calculations of flow through similar periodic arrays. We report below some of the highlights of the work completed during this reporting period.

4205 Materials Testing

REFER ALSO TO CITATION(S) 9376, 9450, 10556, 10669

9675 (AECL—8633) Tomography. Giving industry a new dimension. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 1985. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700275.

Already widely accepted in medicine, tomography can also be useful in industry. The theory behind tomography and a demonstration of the technique to inspect a motorcycle carburetor is presented. To demonstrate the potential of computer assisted tomography (CAT) to accurately locate defects in three dimensions, a sectioned 5 cm gate valve with a shrink cavity made visible by the sectioning was tomographically imaged using a Co-60 source. The tomographic images revealed a larger cavity below the sectioned surface. The position of this cavity was located with an in-plane and axial precision of approximately +-1 mm. The volume of the cavity was estimated to be approximately 40 mm^3.

9676 (BDX—613-3613) Image analyzer evaluation: Final report. Schlueter, M.E. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Dec 1986. Contract AC04-76DP00613. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003581.

The Materials Evaluation Laboratory acquired a metallograph with a computer controlled image analysis system capable of storing, retrieving, processing, and measuring visual image data obtained from a microscope. A review of the system's capabilities and of associated literature sources was undertaken to determine the implementation plan for various applications. Some of these applications ultimately will be used in coordination with an overall expert system for laboratory image analysis. This system was obtained to expand and refine the quantitative materials image analysis capabilities within the laboratory. Not only will manual testing methodologies be improved upon, but new techniques in image manipulation and information processing and storage will be devised as the needs to quantify more complex material systems arise. Several methods have been developed. These include the determination of the percentage of ferrite content in stainless steel and the amount of binder used in powder metallurgy parts. Other applications are under development and include user interactive measurements of linear date on several types of materials.

9677 (CONF-860856—8) Photon CT scanning of advanced ceramic materials. Sawicka, B.D.; Ellingson, W.A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Argonne National Lab., IL (USA)). Oct 1986. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001525.

From Conference on review of progress in quantitative NDE; San Diego, CA, USA (3 Aug 1986).

Computed tomography (CT) using a high energy (1.25 MeV) photon source has been employed to image two specimens of sintered alumina ceramic. Because a monoenergetic source was used the absolute values of the densities could be measured to a high accuracy. High contrast (low noise) CT images were obtained permitting density measurement within each pixel to be determined with an accuracy of better than 1%. The average densities in regions encompassing several pixels have been determined with an accuracy of 0.2%. Porous regions and long-range density gradients were observed and quantified. Higher spatial resolution and still better contrast of the CT image could be obtained, however at the expense of the scan time. Good agreement was obtained for the two imaging techniques (CT and contact radiography), although both techniques showed slightly different features in the objects under study and therefore complement each other.

9678 (EGG-M—11286) Numerical calculations of acoustic emission. Johnson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 9p. (CONF-860856—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87000440.

From Conference on review of progress in quantitative NDE; San Diego, CA, USA (3 Aug 1986).

A computer program which solves the partial differential equations for sound propagation numerically is applied to the study of problems in acoustic emission. The program uses finite difference techniques to calculate sound fields due to distributions of sources in complex geometries in two dimensions. The potential to handle more complex geometries and to model more realistic sources is the main advantage of this type of calculation over the analytic calculations. The main disadvantage of the numerical technique is the cost of obtaining results since a large main frame computer or supercomputer is required. In this paper the fields due to a simple source in a planar geometry are calculated and compared to the analytic results using the methods developed by Pao and his collaborators. The purpose of these calculations is to test the feasibility of the code for calculations of acoustic emissions and to determine the limitations by comparing it with the Green's function or generalized ray theory results. Further calculations in more complex geometries which cannot be handled by the Green's function method are planned, including the effect of sources near or at the tip of a crack and the effect of geometric distortions due to plastic strain in a sample in a tension test.

9679 (FhG-IzfP—780157-TW) Scatter of even ultrasonic waves on spherical isotropic inclusions in an isotropic medium. Hirsekorn, S. (comp.). (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken (Germany, F.R.). Inst. fuer Zerstoerungsfreie Pruefverfahren). 23 Jan 1979. 85p. (In German). Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken, Germany, F.R., Inst. fuer Zerstoerungsfreie Pruefverfanren.

For incoming longitudinal and tranverse waves, the scatter cross-section for elastic and liquid spherical isotropic inclusions in the elastic medium and for vacua are calculated. A series of errors from the primary and secondary literature was corrected. Computer programmes were compiled for some cases and calculated the standardized scatter cross-section for various combinations of matrix and scatterer. The problems of numerical calculation and vacua in liquids and in elastic media are explained in detail. Data on oscillation of the standardized scatter cross-section, the Rayleigh approximation, the scatter at typical spheres, problems in wave conversion and of multiple scatter are given. Finally, the theory is extended to the polycrystalline matrix. (orig./HWJ).

9680 (FhG-IzfP—790218-TW) **Scatter of even ultrasonic waves on spherical isotropic inclusions in an isotropic medium, taking multiple scatter into account.** Hirsekorn, S. (comp.). (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken (Germany, F.R.). Inst. fuer Zerstoerungsfreie Pruefverfahren). 23 May 1979. 98p. (In German). Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken, Germany, F.R., Inst. fuer Zerstoerungsfreie Pruefverfanren.

The scatter conditions of even ultrasonic waves in spherical inclusions in two-phase systems were examined experimentally and by calculation. With a high density of scatter and great differences in the speed of sound or the density between the matrix and second phase, the scatter waves of other inclusions cannot be neglected with waves impinging on one scatterer. This problem of multiple scatter and the speed dispersion with incoming longitudinal waves was analysed for isotropic spherical inclusions in an isotropic matrix. Systems with solid and liquid matrices were included, where the scatterer contained a substance different from the matrix. A computer programme was compiled for calculating the phase and group speeds and the scatter coefficient. The results of some calculated examples are submitted. Instructions are given on the validity of simple scatter and the theory of multiple scatter. (HWJ).

9681 (FRNC-TH—2291) **Fluid flows due to leakproofness defects of nuclear fuel cans: application to sipping in PWR.** Parrat, D. (Institut National Polytechnique, 38 - Grenoble (France)). Oct 1983. 286p. (In French). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750724.

This thesis establishes the theoritical laws describing fluid and gas transfers through channels representative of nuclear fuel can defects. These laws, applied to craks on fuel cans (samples) and on new or spent experimental rods, allow to know their size. A computerized modelling has been developed to analyse more particularly the examination by "quantitative permeation testing", giving the equivalent size of a channel from the observed signal. The utilization of this process to non-tight fuel assemblies of pressurized water reactors leads to the establishment of a classification of defects according to their importance.

9682 (INDC(NDS)—179/G, pp 107-116) **On the influence and need of nuclear data at relative standardized fluence measurements.** Baers, B.; Seren, T. (Technical Research Centre, Espoo, Finland. Reactor Lab.). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

The quality of the fast neutron fluence estimates to be used at the prediction of pressure vessel (PV) steel embrittlement may be significantly improved by the combined use of PV cladding dosimetry (Fe,Ni,Nb), by applying relative standardized measurements and by utilizing the low energy threshold reaction ^{93}Nb(n,n')^{93}sup(m)Nb. In this way the influence of the relatively large systematic (correlated) errors in the reaction cross sections (and possibly other nuclear data) and in the spectrum shapes at the surveillance chain (SC) and at the PV may be significantly suppressed. The influence and need of nuclear data at these types of measurements is discussed and is exemplified by the use of the ^{54}Fe(n,p)^{54}Mn and ^{93}Nb(n,n')^{93}sup(m)Nb reactions. Iron is a common reactor structural material, which also may be used for dosimetric purposes by the sampling or scraping technique. The Nb-reaction is of special importance due to its low threshold energy (approx. 1 MeV) and long half-life (16.1 y) and due to practical problems with the low threshold energy fission reactions. The quality of the dose estimates, especially the absolute ones, may be further improved if the uncertainties in some Nb data (cross section and γ to X conversion probability), and the relatively large discrepancies between the measured and calculated (Nb) cross sections could be reduced. 18 refs, 3 figs, 3 tabs.

9683 (INDC(NDS)—179/G, pp 117-125) **Bench mark spectra for high-energy neutron dosimetry.** Dierckx, R. (Commission of the European Communities, Ispra, Italy. Joint Research Centre). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

To monitor radiation damage experiments, activation detectors are commonly used. The precision of the results obtained by the multiple foil analysis is largely increased by the intercalibration in bench-mark spectra. This technique is already used in dosimetry measurements for fission reactors. To produce neutron spectra similar to fusion reactor and high-energy high-intensity neutron sources (d-Li or spallation), accelerators can be used. Some possible solutions as p-Be and d-D_2O neutron sources, useful as bench-mark spectra are described. 10 refs, 4 figs.

9684 (INDC(NDS)—179/G, pp 141-146) **Neutron dosimetry for fusion materials studies.** Greenwood, L.R. (Argonne National Lab., IL, USA). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

We are engaged in a program to characterize irradiation facilities for the U.S. fusion materials program. In lieu of an operating high-flux fusion reactor, experiments are being performed in a variety of facilities, including fission reactors, 14MeV T(d,n) sources, and accelerator-based neutron sources. Our goal is to develop techniques to characterize each source in terms of neutron exposure and induced damage, gas production, and other transmutation. Papers concerning radiation damage calculations and helium production measurements are also included in these proceedings. The present paper summarizes our efforts to measure neutron fluences and energy spectra during materials irradiations. The neutron environment can be sampled during an irradiation by measuring the induced activation in carefully selected materials. These integral activities can then be used to adjust calculated neutron spectra. This technique relies on our knowledge of neutron activation cross sections. Consequently, neutron cross sections are being measured at various facilities in order to improve this technique and to extend it to higher neutron energies. 9 refs, 4 figs, 1 tab.

9685 (IS-T—1226) **Experimental evaluation of Gaussian and Gaussian-Hermite beam theories as tools for modeling scanned ultrasonic measurements.** Newberry, B.P. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003051.

Presented here are the experimentally determined radiation fields of focussed and unfocussed piston tranducers radiating through both planar and cylindrical liquid-solid interfaces at both normal and non-normal incidences. Comparisons are made with the fields predicted by the Gaussian and Gaussian-Hermite theories. The theories are shown to work well within the limits of the assumptions made and within the range of the cases studied. Also presented is a comparison of experimentally determined probability of detection (POD) curves with those predicted by a POD theory which utilizes the Gaussian beam theory.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 9288, 9309, 9449

9686 (CAPE—2987) **Q-5789 RC time constant unit.** Delorenzo, J.T. (Oak Ridge National Lab., TN (USA). Instrumentation and Controls Div.). [1986]. Contract AC05-84OR21400. OSTI, PO Bx 62, Oak Ridge, TN 37831. File Number TI87000213.

Engineering drawings are included for a single-width NIM module to generate exponentially shaped output pulses for each fast-NIM logic level input pulse. The rms voltage out is related by

Campbell's theorem to the square root of the input count rate. Front panel adjustments are provided to select output pulse amplitude and RC shaping time constants.

9687 **(LBL—21929) Quad delay gate generator (LBL No. 21X6691 P-2).** McDonald, R.J.; Maier, M.R.; Landis, D.A.; Wozniak, G.J. (Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003633.

A quad delay gate generator has been designed and packaged in a single-width NIM module. Both delay times and gate widths may be set continuously from 25 ns to 120 μsec. In normal operation, the gate follows the delay time unless a "stop" pulse cuts it short. Alternatively, the module may be operated in a bipolar mode, where the delay time is set by the input "start" pulse and reset by the input "stop" pulse. Modes and coarse time ranges are set via an octal DIP switch on the front panel. Fine adjustments of the delay and gate width are made via two twenty-turn potentiometers. Stability over a several day period was measured at ~ 250 ps on the 120 ns full scale range. LEDs gives a visual indication of both the input rate and the dead time.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 8864, 9078, 9422, 9907

9688 **(BMFT-FB-T—86-065) Calculation of unsteady behavior of a PFBC-plant in case of abnormal operation. Final report.** Rauhut, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Hochschule Aachen (Germany, F.R.). Inst. fuer Dampf- und Gasturbinen). Oct 1986. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750790.

In the heat and power plant of the Techn. Univ. of Aachen a pressurized fluidized bed fired boiler of 40 MW has been installed. This is the first 40 MW-Plant with a PFBC-Boiler. The air for fluidisation and combustion is supplied to the combustor by an arrangement of a turbocharger's compressor followed by an electrically driven compressor. In case of abnormal operating conditions overspeed of the turbocharger and compressor-surge are to avoid. A computer program and some results of calculated examples are presented. These results demonstrate the capability of the arrangement and of the control system to face the abnormal situations suggested. Even in case of shut down conditions, pressure differences within the plant and speed of rotating equipment do not exceed tolerable limits. With 7 refs., 176 figs.

9689 **(BMFT-FB-T—86-070) Erection and operation of an atmospheric fluidized bed firing system for a useful heat capacity of 3 MW (10,8 GJ/h), laid out as a component testing plant. Final report.** Jagnow, H.-J.; Kirchhoff, R.; Still, D.; Busch, U. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.)). Oct 1986. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87750791.

Bergbau-Forschung GmbH erected a component testing plant (KTA) for a fluidized bed system (useful heat capacity 3 MW) carry out market-orientated tests with a view at basic improvement of atmospheric, stationary fluidized bed technology. At the same time first preliminary trials for the design of novel components were implemented in a semi-technical fluidized bed plant (heat capacity 0,4 MW). The component testing plant was erected by the joint companies of Thyssen Engineering/Standardkessel on the premises of 'Koenigin Elisabeth' in Essen-Frillendorf. The plant was commissioned on October 1, 1984. After trials on the different plant components, the plant served as a test unit for defining comparative standard conditions for different feed coals. Since May 1, 1985, the component testing plant has been available for the development of novel components appropriate for an improved utilization of the fluid-mechanical properties of fluidized beds. With 10 refs., 10 tabs., 54 figs.

9690 **(DOE/PC/80511—T5) Hydrodynamics, mixing, and segregation in gas fluidized beds: Technical progress report for research performed during period 22 July 1986 to 21 October 1986.** Chen, M.M.; Chao, B.T. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 1986. Contract FG22-85PC80511. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003164.

The experimental data on the solids mixing and turbulent correlations, obtained previously using the Computer Aided Particle Tracking Facility (CAPTF) at the University of Illinois at Urbana-Champaign and partially reported previously, were completed and examined in order to acquire a better understanding of the mechanism of the solids mixing. In addition, correlations of the detector signals during steady-state multi-particle tracking experiments were examined to shed light on the nature of solids motion in the bed. These activities are described in detail in this report and in the appendix. The paper in the appendix, "Experimental and numerical simulation of solids mixing in a gas-solid fluidized bed," has been processed separately for inclusion in the Energy Data Base. 4 figs., 1 tab.

9691 **(DOE/PC/80511—T5, pp 68, Appendix) Experimental and numerical simulation of solids mixing in a gas-solid fluidized bed.** Moslemian, D.; Chen, M.M.; Chao, B.T. (Florida Atlantic Univ., Boca Raton; Univ. of Illinois, Urbana). 1986. NTIS, PC A05/MF A01. File Number DE87003164.

In Hydrodynamics, mixing, and segregation in gas fluidized beds: Technical progress report for research performed during period 22 July 1986 to 21 October 1986.

Solids mixing in a gas fluidized bed may be viewed as the consequence of two mechanisms: Convective mixing due to the large scale circulatory motion of the particles, and dispersive mixing due to their small scale chaotic motion. Previous models of the mixing process did not account for the convective contribution explicitly, because of the lack of definitive quantitative information on the large scale particle circulation. Such information has recently been obtained through the use of a Computer-Aided Particle Tracking Facility developed at the University of Illinois at Urbana-Champaign. Accordingly, solids mixing was investigated both experimentally and numerically empolying this unique facility. It had two modes of operation. In the single particle tracking mode, the solids mean velocity, the particulates density, and turbulent quantities leading to solids dispersion coefficients were inferred by tracking the motion of a single radioactive tracer particle. In the multiparticle tracking mode, a collection of radioactive tracer particles were introduced into the bed and their migration and dispersion were tracked to experimentally study the mixing process. A transit convection-diffusion model was employed for the numerical simulation of the process. In this model the measured mean solids velocities were used to account for the convective contribution and the solids dispersion coefficients were utilized to assess the dispersive contribution to the mixing process. 15 refs., 35 figs.

9692 **(EPRI-CS—4844) Spectral flame analyzer for burner control in fossil fuel boilers: Final report.** Metcalfe, C.I.; Cole, W.E.; Fraim, F.W.; Batra, S.K. (Thermo Electron Corp., Waltham, MA (USA). Thermal Products Div.). Nov 1986. 73p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920142.

A prototype spectral flame analyzer installed on a 360-MW coal-fired boiler accurately measured spectral emissions from the combustion zone of an individual burner. The tests indicated that the instrument has the potential to monitor and control the air-to-fuel ratio of such burners.

9693 **(KFK-PEF—6) Optimization of small oil-fired burners: Reduction of NO/sub x/, unburned hydrocarbons, and additional pollutants.** Wittig, S.; Kutz, R.; Steinebrunner, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). Feb 1986. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750803.

The optimization of the combustion processes in oil-fired small burners is one of the research efforts at the Institute for Thermal Turbomachinery at the University of Karlsruhe. Of primary interest is the interdependence of the flow field and the fuel atomization and its influence on pollutant emissions. Detailed flow field measurements as well as the spray- and emission-measurements have been performed. Utilizing experimental facilities especially designed for the analysis of the various influence parameters, it has been shown that the pollutant emission is strongly dependent on the proper matching of the air-addition (flow field) and the fuel atomization. In illustrating the flow field and spray characteristics, typical NO/sub x/-emissions are compared with results obtained from advanced calculational models. The agreement between experiment and theory is relatively good and sufficient under practical considerations. Finally, optimization rules are discussed. It is shown that in applying relatively simple techniques such as the proper use of swirlers, conventional yellow-burners can be improved to the level which is usually attributed to so-called "blue-flame-burners". The ongoing research efforts at present are directed towards a broader application of pressure atomizers and will be extended to emission measurements in so-called "hot combustors". Calculation of the NO/sub x/- as well as the CO-emissions are planned with emphasis for the broader application of the calculational code. With 37 figs., 25 refs.

9694 **Recuperative furnace.** Hays, H.G.; Kuipers, W.W. (to Amana Refrigeration, Inc., Amana). US Patent 4,622,947. 18 Nov 1986. Filed date 16 Mar 1984. v.p.

This patent describes a forced air furnace, comprising: means for combusting fuel; an air duct; a first heat exchanger coupled to the air duct, the first heat exchanger having at least one conduit coupled to the combusting means; the conduit having a fluid flowing therein for transferring heat from the combusting means to the first heat exchanger; a second heat exchanger positioned in the air duct below the first heat exchanger, the second heat exchanger receiving the combustion products directly from the combusting means; an air blower having its output coupled upward to the second heat exchanger for preheating the air from thermal transfer from the combustion products and from heat of condensation given off by a portion of the combustion products condensing in the second heat exchanger; and the preheated air from the second heat exchanger being coupled upward to the first heat exchanger for further heating the preheated air from thermal transfer from the first heat exchanger.

9695 **Jet impingement/radiation gas-fired cooking range.** Hurley, J.R.; Birkner, J.R.; Nunes, M. (to Thermo Electron Corp., Waltham, MA). US Patent 4,622,946. 18 Nov 1986. Filed date 16 May 1985. v.p.

This patent describes a gas-fired cooking range comprising at least one burner, a valving device connected to the burner, an air plenum having an air outlet connected to the valving device, means for supplying pressurized air to the air plenum, a fuel gas manifold having a gas outlet connected to the valving device. The valving device is operable to form a pressurized mixture of fuel gas and air. The range has an adjusting means connected to the valving device to control the rate of flow of the mixture to the burner connected to the valving device, means for maintaining predetermined proportions of fuel gas and air in the mixture at all rates of flow of the mixture set by the adjusting means, support means for supporting a cooking utensil above the burner, and a jet plate positioned between the support means and the burner. The jet plate has a domed, convex-upward shape and includes protrusions extending upwardly towards the support means and has a jet hole in the top of the protrusion. The burner is operable to direct combustion cases towards the jet plate to heat the jet plate to a temperature of up to about 1500°F. and to cause convective jets of gases to formed by the jet holes. The jet plate thereby transfers heat energy to the utensil both by radiation and by impact of the convective jets on the bottom surface of the vessel.

9696 **Combined sulphur burning furnace and boiler.** Cameron, G.M.; McFarland, J. (to C-I-L, Inc., North York). US Patent 4,622,921. 18 Nov 1986. Filed date 25 Nov 1985. v.p.

This patent describes an apparatus for producing a cooled, gaseous sulphur dioxide-air mixture comprising an external shell of a strong heat resistant material; sulphur burning means to provide an upwardly directed axial flow of a hot, gaseous sulphur dioxide-air mixture within the external shell; water-cooled boiler tubes within the external shell. The apparatus is so arranged as (a) to define an upper inner chamber above the sulphur burning means to receive the hot gaseous mixture in axial flow from the sulphur burning means, (b) to define with the external shell an upper outer chamber to receive the gaseous mixture from the upper inner chamber by radial outflow, and (c) to permit the radial outflow of the gaseous mixture from the upper inner chamber to the upper outer chamber and to effect cooling of the gaseous mixture; and cooled gaseous mixture exit means.

9697 **Steam turbine exhaust pipe erosion prevention system.** Draper, R.; Silvestri, G.J. Jr.; Hargrove, H.G. (to Westinghouse Electric Corp., Pittsburgh, PA). US Patent 4,622,819. 18 Nov 1986. Filed date 29 Jan 1985. v.p.

This patent describes an erosion-prevention device for a fluid-carrying pipe means, the fluid comprising a discontinuous liquid phase portion, the device comprising: a. liner means of predetermined length and disposed concentrically within the pipe means with a predetermined clearance between the liner means and the pipe means, the clearance between the liner means and the pipe means defining an annular space. The liner means has opening means therethrough for diverting a liquid layer formed from the discontinuous liquid phase portion to the annular space the liner means affixed at the ends thereof to the pipe means; b. liner wick means positioned within and substantially filing the annular space; c. collection means disposed within the annular space positioned substantially parallel with the axis of the pipe means for collecting a substantial portion of the diverted liquid layer; d. liner drain means for draining the collected diverted liquid layer comprising drain pipe means in fluid communication with the collection means. The liquid layer which is formed by the erosion causing liquid phase droplets is diverted from the pipe means thereby diminishing the erosion of the pipe means.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 8883

9698 **(GKSS—86/E/22) GKSS-underwater-simulation-facility (GUSI). Safety and performance in the first two years of operation.** Schmidt, K.; Schnegelsberg, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1986. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750801.

After two years operation of the GKSS underwater simulation plant GUSI the important safety and operation related experiences will be reported. Seven saturation dives have been performed with the plant maintaining isopression phases between 125 and 500 m depth of water. This represents a total of 181 days of emergency free operation with no health problems for the divers involved. The GUSI has demonstrated its ability to establish safe diving conditions with high technical reliability. Diving techniques and equipment are under development in cooperation with universities and industry as the state of the art will be exceeded as greater diving depths are achieved. With 20 figs., 3 tabs.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 9040, 9909

9699 **Recirculating electric air filter.** Bergman, W. (to Dept. of Energy, Washington, DC). US Patent 4,623,365. 18 Nov 1986. Filed date 9 Jan 1985. v.p.

This patent describes a recirculating electric air filter comprising: a hollow air permeable inner high voltage electrode connected to a DC high voltage source; a removable filter material surrounding the inner electrode; an electrically grounded outer air permeable ground electrode mounted around, spaced apart from and electrically insulated from the inner electrode and containing the filter material therebetween. The outer electrode is formed of segments moveably connected together to allow easy disassembly for removing the filter material; the inner electrode, filter material, and outer electrode defining an air flow path therethrough between the exterior of the outer electrode and interior of the inner electrode; an insulated sealing flange at one end of the electrodes for providing a seal between the inner and outer electrode; an insulated plate at the opposite end of the electrodes for providing a seal across the end of the air filter; a base having the electrodes mounted thereto and containing a blower means for drawing air out from or blowing air into the inner electrode.

4250 Power Cycles

9700 (ANL-CT—86-2) **SEAMOPT: A Stirling engine performance optimization code.** Heames, T.J.; Daley, J.G.; Minkoff, M. (Argonne National Lab., IL (USA)). May 1986. Contract W-31-109-ENG-38. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003580.

A computer code for Stirling engine research and design is described. The code system, SEAMOPT, has been used to: optimize component and engine performance, modify an existing engine to meet new application requirements, and identify design methods that lead to performance improvement and simplified engine design. SEAMOPT consists of a full Stirling engine simulation linked to a rigorous optimization code through an interface module which defines performance objectives and constraints which might limit values of design variables. Calculated results are presented from two example problems using the GPU-3 Stirling engine as a base design. The first example shows how regenerator dimensions can be changed to achieve three different performance objectives. The second example shows changes in the entire thermodynamic section needed to increase power by a factor of 8 while maintaining efficiency. The code, which requires 65K words of memory, executed problem 1 in 45 seconds and problem 2 in 10 minutes on an IBM 3033. 13 refs., 10 figs., 10 tabs.

43 PARTICLE ACCELERATORS

9701 (KEK—84-14, pp 310-329) **Report on the panel discussion on future R and D cooperation.** Sessler, A.M. (Lawrence Berkeley Lab., CA, USA). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

This report describes briefly the points presented at the panel discussion on future R and D cooperation, held on May 17, 1984. In order to understand the extent and nature of the R and D on accelerators, the advanced portion of accelerator R and D in the US was presented. The present status of National Laboratories and special research project groups are described. The categorization of R and D was made. The parallel R and D means that no joint funding and no formal coordination between different R and D groups. The collaborative R and D means that two or more groups pool resources (e.g. superconductive rf work among DESY, CERN, Karlsruhe). The coordinated R and D means that work gets divided among participating groups. It was the view of the panel that a more formal system of cooperation is called for.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 10599, 10602, 10605

9702 (BNL—38812) **Relativistic Heavy Ion Collider.** Willen, E.H. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 7p. (CONF-860870—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002581.

From 13. international conference on high energy accelerators; Novosibirsk, USSR (7 Aug 1986).

The Relativistic Heavy Ion Collider (RHIC) is a proposed research facility at Brookhaven National Laboratory to study the collision of beams of heavy ions, up to gold in mass and at beam energies up to 100 GeV/nucleon. The physics to be explored by this collider is an overlap between the traditional disciplines of nuclear physics and high energy physics and is a continuation of the planned program of light and heavy ion physics at BNL. The machine is to be constructed in the now-empty tunnel built for the former CBA project. Various other facilities to support the collider are either in place or under construction at BNL. The collider itself, including the magnets, is in an advanced state of design, and a construction start is anticipated in the next several years.

9703 (BNL—38917) **Status of Switched-Power Linac studies at BNL [Brookhaven National Laboratory] and CERN [European Organization for Nuclear Research].** Aronson, S. (Brookhaven National Lab., Upton, NY (USA)). 31 Oct 1986. Contract AC02-76CH00016. 16p. (CONF-8608123—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003204.

From Advanced accelerator concepts conference; Madison, WI, USA (21 Aug 1986).

The switched-power linac (SPL) concepts are reviewed briefly, and recent work on computer-modelling of the photoemission process at the photocathode and the experimental study of the process are discussed. Work on rf-modelling of the properties of the radial transmission line is outlined. (LEW)

9704 (BNL—38947) **Energy efficiency and choice of parameters for linear colliders.** Claus, J. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 34p. (CONF-860570—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003201.

From INFN Eloisatron Project: seminar on new techniques for future accelerators; Erice, Trapani, Italy (11 May 1986).

Three possible ways of converting beam power into luminosity are investigated: two short bunches colliding with each other, two long ones doing so, and two pulses of bunch trains which interact. Some of the implications of linacs for very high frequencies are considered, emphasizing the factors that influence the efficiency of converting rf power into luminosity and assuming that suitable power sources are or will be available. Some characteristics of structures that seem feasible for very high frequency accelerators are described. 6 refs., 6 figs. (LEW)

9705 (DOE/SF/00515—T70) **Stanford Linear Accelerator Center: Monthly report for October 1986.** (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1986. Contract AC03-76SF00515. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003017.

Operational activities for the month of October 1986 are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, and publications for the month. Approved experiments are tabulated. (LEW)

9706 (GSI—86-27-Prepr.) **Development of RF-linac and storage ring system for high-current experiments at GSI.** Hofmann, I. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1986. 16p. (CONF-860510—18). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750318.

From Symposium on heavy ion inertial fusion; Washington, DC, USA (27 May 1986).

The heavy ion facility under construction at GSI is suitable for the generation of high-current beams. It consists of a new high-current injector into the Unilac and a synchrotron and storage ring. We discuss the capability of this system to produce short pulses of heavy ions with a specific energy of the order of 0.1 MJ/g. Under these conditions the system allows to perform a first generation of heavy ion driven target experiments and to test most of the critical issues of a large scale heavy ion fusion driver facility.

9707 (INFN/AE—86/7) **Conceptual design of the EHF [European Hadron Facility].** Bradamante, F. (Trieste Univ. (Italy). Dipartimento di Fisica). 21 May 1986. 30p. (CONF-8603145—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900279.

From International conference on a European hadron facility; Mainz, F.R. Germany (10 Mar 1986).

The European Hadron Facility (EHF) is a high current proton synchrotron in the 30 to 40 GeV energy range to be built in western Europe. A preliminary conceptual design has been worked out, and the various accelerators involved and criteria adopted are described. Accelerator parameters are considered, and beam losses are discussed. The injection scheme from linac to booster is described. The importance of accelerating polarized proton beams of the same intensity as the unpolarized beams is discussed, and ways of maintaining polarization are discussed. Facility costs are estimated. (LEW)

9708 (INIS-SU—369, pp 3-7) **ITEP complex for proton and heavy ion acceleration.** Bol'shakov, A.E.; Vasil'ev, A.A.; Veselov, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

A status of construction of the ITEP proton-heavy-ion complex is described. The ITEP proton-heavy-ion accelerating complex is developed on the basis of a proton synchrotron. The design developed envisages ion acceleration with different initial charges. Works are planned to perform during two stages. During the first stage of the desgon it is planned to use only one existing magnetic system. At that ions of the first half of the Mendeleev system will be accelerated up to 0.7-1.0 GeV/n. The second stage envisages the construction additional superconducting ring. When ion transport from the first ring to the second one they will be completely stripped. Energy of accelerated heavy ions will reach, at that, approximately 9 GeV/n. Two-gap injector-accelerator is being furnished. Works on RF system move forward. It is suggested to use the system of distributed pumping out on the basis of getter and to produce 10sup(-10) Torr vacuum. Development of a heavy ion source has begun.

9709 (INIS-SU—369, pp 168-171) **Study on the magnetically insulated diode for negative ion kilo amp beam production.** Agafonov, A.V.; Kolomenskij, A.A.; Lebedev, A.N. (AN SSSR, Moscow. Fizicheskij Inst.). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Experimental results on negative ion production in the EhRG and the "Pulse" accelerators (electron energy E=600-1000 keV, current J=30-40 kA pulse duration T=100-200 ns); (E=500-700 keV, J=20-30 kA, T=100-150 ns) correspondingly are presented. Magnetically insulated coaxial diode (cathode diameter is 30-40 mm, anode - 60 mm) was used. For plasma production the dielectricsurface break-down was realized. Sectional graphite target was applied for the ion sign control by their deflection in the magnetic field. To determine ion type, an aluminized lavsan film was positioned in the drift space. Experimental results of the study of dielectric break-down quality are given. In the experiments conducted the H^- currents from 1 to 5 kA at current density 10-40 A/cm^2 are produced.

9710 (INIS-SU—369, pp 272-275) **Design parameters of a storage ring - stretcher for the KhFTI AN USSR 2000 MeV electron linac.** Bulyak, E.V.; Vishnyakov, V.A.; Gladkikh, P.I. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

One of nearest stages of modernization of the 2 GeV Kharkov electron linac is associated with the increase of pulsed beam current up to 100 mA, energy dispersion monochromatization up to +-0.15% and obtaining emittance up to 10sup(-7) mrad, improvement of the beam duty factor. Construction of a storage stretcherring (SSR) at the outlet of the accelerator is suggested for this purpose. Basic parameters of 0.5-2 GeV SSR with the orbit parth equal to 141.16 m are given. Results of simulation of slow beam extraction from the SSR are presented.

9711 (INIS-SU—369, pp 384-387) **Station of the U-70 synchrotron for beam rebunching into the UNK accelerating field frequency.** Vasil'ev, V.A.; Gurov, G.G.; Malovitskij, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

In accordance with the program of the U-70 synchrotron preparing to the operation as the UNK injector, a station for beam rebunching from 6 MHz frequency into 200 MHz accelerating field frequency (brs) is created at the U-70. The description of the brs first stage equipment is presented. A resonator accelerating system with bridge supply is applied in brs. To feed Rf power to the accelerating system it is supposed to use a wavequide feeder. The accelerating system construction is completed now. Funing and testing of first Rf-section and two output units of 25 kW standard TV station TV-50/15-3 are carried out. Waveguide feeder of the length of about 140 m is fully produced. Radiotechnical measurements at all its standardelements are conducted, the feeder mounting at the acceleratoris begun. The general technological systems are fully produced and mounted and their adjustment is being conducted.

9712 **(INS—1982/ZDAJ/PL/B) Cyclotron C 30 for short living isotopes production used in medicine and industry.** Sura, J.; Weychert, C.; Kulinski, S.; Getka, S. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1983. 25p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901, Warsaw, Poland.

The small isochronous cyclotron C 30 with 105 cm pole diameter will accelerate H^- particles up to 31 Mev and D^- to 16 MeV. The particles extracted by stripping will be used for the production of short-lived isotopes mostly used in medicine and industry. As in the U-200P cyclotron, the magnetic structure consists of 4 straight sectors with shimmed surfaces. This structure allows the finding of the proper mean magnetic field in the centre for H^- 1.743 T and D^- 1.765 T. The accelerating system involves two shorted 45 deg. The H^- particles are accelerated in the second harmonic mode at RF frequency 53.14 MHz, and D^- in the fourth harmonic mode at 53.84 MHz. The cyclotron C 30 has a compact construction, needs low energy and cooling water supply and can be installed in a hall of 5 x 5 m. It is simple to operate due to nearly fix-frequency RF operation and due to the lack of correcting coils system.

9713 (KEK—84-14, pp 17-22) **Status of the BEPC.** Feng, Baoshu; Yu, Zhonggiang. (Academia Sinica, Beijing, China. Inst. of High Energy Physics). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

9714 (KEK—84-14, pp 187-206) **SSC Reference Designs Study.** Tigner, M. (Cornell Univ., USA). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

In the Reference Designs Study we have shown that the basic principles of design used successfully for existing accelerators can be conservatively extended to a proton-proton collider having the SSC primary specifications of energy and luminosity. Furthermore, each of the three reference magnet styles studied could serve as the foundation for an SSC facility meeting these specifications. A vigorous R and D program of approximately three years duration will be required to refine the cost estimates for the magnets, to determine their actual performance, to determine their manufacturability and reliability, and to develop cost-effective methods for their assembly and quality assurance. It is anticipated that the magnet options can be narrowed to a single design during an early phase of the R and D program. An important R and D goal will be to produce, using mass-production methods, a significant number of magnets of the chosen style. These magnets would then be thoroughly tested under conditions simulating actual collider operations. Taking into account the range of computed costs for facilities based on the three magnet styles, the current state of knowledge about the various important cost factors, and the normal contingencies associated with similar technical systems, it is concluded that the SSC facility described herein would cost between \$2.70 billion and \$3.05 billion [FY 1984 dollars]; with intense R and D efforts, even lower costs should result.

9715 (KEK—84-14, pp 68-85) **Status of the FNAL Tevatron program.** Tollestrup, A.V. (Fermi National Accelerator Lab., Batavia, IL, USA). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

The Tevatron is a 1,000 GeV accelerator constructed from superconducting magnets. The recent successful commissioning of this ring has been a milestone in the development of accelerators. The machine has recently started running for the fixed target physics program at 800 GeV. Its statistics of performance are shown. It is seen that the Tevatron is still the least reliable component of the accelerator. It is expected that the reliability will improve considerably as more experience is obtained with the machine. Over 30 fixed target experiments are at present approved, including a beam dump prompt neutrino experiment, polarized proton experiment, muon scattering experiment, and photon experiment. The layout of all the beams either existing, planned, or under construction is shown. It is seem that the experiments span the whole field of high energy physics. The colliding beam program at Fermilab will study the collision between protons and anti-protons in the Tevatron at a center of mass energy of 2 TeV. The experimental program is expected to be commenced in early 1986.

9716 (KEK—84-14, pp 95-109) **IHEP Accelerating and storage complex (UNK).** Myznikov, K.P.; Soloviev, L.D.; Yarba, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

The project of IHEP (Institute of High Energy Physics) accelerating and storage complex envisages a feasibility of operation in the following modes: (1) acceleration of protons to 3 TeV for fixed-target experiment; (2) proton-proton colliding beam of energy 400 x 3000 GeV which will give a c.m.s. energy of 2.2 TeV; (3) further increase of energy in pp-collision up to 6 TeV in the c.m.s. The UNK ring tunnel will comprise a 600 GeV booster with conventional magnets and a superconducting ring to accelerate protons up to an energy of 3 TeV. Presently, the major systems of UNK are under development and technological and energy supply buildings are being designed and constructed. It is planned that the construction of the 3 TeV accelerator will be finished in 1992 or 1993. This document describes the outline of the IHEP project including the present status of construction and testing.

9717 (KEK—84-14, pp 226-238) **Large linear colliders.** Richter, B. (Stanford Univ., CA, USA). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

This is a status report on the works done at SLAC on the studies of large linear colliders (LLC) with the energy for beyond those attainable with either the SLC or LEP. The energy and luminosity requirements for a LLC, the design equations for these machines, and the works being done for the optimization of parameters are discussed. The energy requirement was set at about 2 TeV for a positron-electron collision system. The luminosity to be obtained was around 10^{33} /cm^2.s for a practical machine. Through the optimization program, the parameters obtained for the present 2 TeV machine are 125 MV/m of the accelerating gradient, 16 km of total length, 3.5 cm of RF wavelength, 145 MW of total input AC power, and 0.7 percent of fractional energy spread. The effects of the wake field in the linac in this example are extremely severe. The single most important milestone on the road to LLC's is the completion and successful operation of the SLC.

9718 (KEK—84-14, pp 239-274) **Linear colliders.** Balakin, V.E.; Skrinsky, A.N. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

The fundamental physical and technical problems on the creation of linear colliders are considered. Estimation was made on the achievable luminosity for positron-electron, electron-gamma, gamma-gamma, electron-proton, gamma-proton and proton-proton polarized colliding beams at the total energy of up to 1 TeV. The status of VLEPP project is described. In the basic VLEPP mode of operation, two superlinacs, which are several kilometers long with an energy gain of about 100 GeV per 1 km, fed by high-power RF generators set 10 m apart, fire single 0.5 cm long bunches towards another, each containing 10^{12} polarized electrons or positrons. The bunch dynamics are discussed. The action of a variety of factors which perturb the transverse motion of a bunch and are connected with various errors in the positions of the focusing elements and accelerating sections is considered in detail. The strong focusing at the collision point is discussed. The choice of a high rate of acceleration is also discussed.

9719 (KEK—85-6, pp 6-59) **Physics with e^+e^- linear collider in the TeV region.** Orito, S.; Tsukamoto, T. (Tokyo Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

Physics issues of the e^+e^- linear colliders are reviewed in the hundreds GeV to TeV region, as a part of the effort to design the future plan of Japanese high energy physics. In this report, we rather begin with the question of "physics below TeV." and "hadron versus e^+e^- colliding beams". We then try to perform detailed analyses on simulated events of various test reactions to see what we could realistically perform with a e^+e^- collider in TeV region. Then follow reconstruction of the final state and implications of the exercise.

9720 (KEK—85-6, pp 365-379) **Toward high intensity proton facilities. A promising future of the KEK accelerator complex.** Yamazaki, T. (Tokyo Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

Upgrading the KEK 12 GeV proton synchrotron and its booster is significant for the creation of new physics, the high-grade education and cultivation of physicists of next generation and the impacts on other domains of science. The new accelerator complex is proposed and this should attract great enthusism among various science communities. The time schedule will be construction of a super booster in 1987 - 1989, improvements in the main ring in 1986 - 1988, constructions of secondary and primary areas in 1987 - 1991 and a heavy ion injection facility in 1990 - 1991; the main ring to be converted to a superconducting synchrotron in 1990s. Contents are the following: new wave of particle physics, the border region between particle and nuclear physics, possible PS upgrading, etc.

9721 (KFK—4090) **Cluster ion acceleration with the radiofrequency quadrupole.** Moser, H.O.; Schempp, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Frankfurt Univ. (Germany, F.R.). Inst. fuer Angewandte Physik). Jul 1986. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750311.

In order to increase the kinetic energy of accelerated cluster ions in the range beyond 1 MeV, to widen the atomic flux density limit imposed by collision processes in the beam, and to reduce complexity and costs compared with electrostatic acceleration, the use of a radiofrequency quadrupole accelerator is examined. Two cases are considered: firstly, the acceleration of cluster ions in the mass range from 1 to 100 amu from 5 to 50 keV/nucleon which is interesting for basic research, secondly, the acceleration of cluster ions in the mass range from 1 to 10^6 amu from 5 meV to 1 eV/nucleon which is interesting for several technological applications. On the basis of the state of the art, the respective RFQ structures turn out to be feasible.

9722 (LA-UR—86-3760) **Multi-TeV muon colliders.** Neuffer, D. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 9p. (CONF-8608123—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002925.

From Advanced accelerator concepts conference; Madison, WI, USA (21 Aug 1986).

The possibility that muons may be used in a future generation of high-energy high-luminosity $\mu^+ \mu^-$ and $\mu^- p$ colliders is presented. The problem of collecting and cooling high-intensity muon bunches is discussed and ionization cooling is described. High-energy collider scenarios are outlined; muon colliders may become superior to electron colliders in the multi-TeV energy range.

9723 (LBL—22349) **Heavy Ion Fusion Accelerator Research (HIFAR) year-end report, April 1, 1986-September 30, 1986.** (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003642.

Activities are reported on MBE-4, the four-beam proof-of-principle ion induction linear accelerator with the capability of beam-current amplification. Mechanical aspects of MBE-4, quadrupole insulator performance, and pulsers are discussed. The computer code, SLID, has been used to help understand the longitudinal beam dynamics in MBE-4. A computer-controlled emittance scanning system is in use in MBE-4. A systematic effort is under way to discover and correct all the defects peculiar to the low energy part of the linac design code. (LEW)

9724 (LBL—22421) **Heavy-ion fusion system assessment project: Quarterly status report, Jan.-Mar. 1986.** Lee, E.P.; Hovingh, J.; Faltens, A.; Keefe, D. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003643.

The work reported concentrated on the completion of an accelerator system model and its incorporation into the system code. Also reported is an accelerator cost analysis based on an assumed target yield for a given fusion power. (LEW)

9725 (SLAC-PUB—4042-Rev.) **A Solid state accelerator.** Chen, P.; Noble, R.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 6 Nov 1986. Contract AC03-76SF00515. 4p. (CONF-8608123—8-Rev.). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003274.

From Advanced accelerator concepts conference; Madison, WI, USA (21 Aug 1986).

We present a solid state accelerator concept utilizing particle acceleration along crystal channels by longitudinal electron plasma waves in a metal. Acceleration gradients of order 100 GV/cm are theoretically possible, but channeling radiation limits the maximum attainable energy to 10^5 TeV for protons. Beam dechanneling due to multiple scattering is substantially reduced by the high acceleration gradient. Plasma wave dissipation and generation in metals are also discussed.

9726 (UCRL—95317) **Induction linear accelerator technology for SDIO applications.** Birx, D.; Reginato, L.; Rogers, D.; Trimble, D. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 19p. (CONF-861114—32). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003251.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

The research effort reported concentrated primarily on three major activities. The first was aimed at improvements in the accelerator drive system of an induction linac to meet the high repetition rate requirements of SDI applications. The second activity centered on a redesign of the accelerator cells to eliminate the beam breakup instabilities, resulting in optimized beam transport. The third activity sought to improve the source of electrons to achieve a higher quality beam to satisfy the requirement of the free electron laser. (LEW)

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 9654, 9655, 9657, 10516

9727 (BNL—38943) **Modifications in the AUTOMESH and other POISSON Group Codes.** Gupta, R.C. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 6p. (CONF-8610190—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003229.

From Workshop on electromagnetic field computations; Schnectady, NY, USA (20 Oct 1986).

Improvements in the POISSON Group Codes are discussed. These improvements allow one to compute magnetic field to an accuracy of a few parts in 100,000 in quite complicated geometries with a reduced requirement on computational time and computer memory. This can be accomplished mainly by making the mesh dense at some places and sparse at other places. AUTOMESH has been modified so that one can use variable mesh size conveniently and efficiently at a number of places. We will present an example to illustrate these techniques. Several other improvements in the codes AUTOMESH, LATTICE and POISSON will also be discussed.

9728 (CEA-CONF—8444) **Beam dynamics in long transit time linac cavities for heavy ion boosters.** Lapostolle, P.; Valero, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Jun 1986. 4p. (CONF-860629—60; CEA-DPH-N-S—2343). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750715.

From Linear accelerator conference; Stanford, CA, USA (2 Jun 1986).

A new accurate and relatively fast formalism has been derived for beam dynamics through long accelerating elements. This work was initiated by the development of heavy ion booster cavities, in particular of helix type which present no exact symmetry.

9729 (INIS-SU—352, pp 182-186) **Dispersion properties of accelerating structure with conducting washes and diaphragms.** Gonin, I.V.; Paramonov, V.V. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1985. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE87780023. (CONF-8410203—Vol.1).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Dispersion properties of accelerating structure with conducting washers and diaphragms are studied on the basis of the electrodynamical approach. This accelerating structure is used in the basic part of the meson factory linac. The dispersion characteristics are presented as the dependence of oscillation frequency on phase retardation per structure period. Waves propagating without attenuation and losses in structure are studied. Calculations are carried out using the MVLTI-MODE program. The bandwidth boundaries are calculated within the ($3\text{-}4f_0/f_0$ is the frequency of operating oscillation) range. Behaviour of characteristics is considered for different structure variants of proton ($0.4 < = \beta < = 0.9$) and electron ($\beta=1$) accelerators. A conclusion is drawn that violations of axial structure symmetry results in dispersion curves distortion. But for lower characteristics representing the greatest practical interest one may neglect these distortions.

9730 (INIS-SU—352, pp 195-198) **PRVD-W program complex for accelerating structure calculation.** Dajkovskij, A.G.; Portugalov, Yu.I.; Ryabov, A.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE87780023. (CONF-8410203—Vol.1).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

The program packet for the calculation and optimization of accelerator accelerating structures is described. These programs allow one to calculate any oscillation type (both with azimuthal variationand without them) for axisymmetric resonators and periodical structures. Numerical solution of the problems is performed by quantization using the finite element method and eight-nodal isoparametric elements. Algebraic equations are solved by the method of subspace iteration, which permits to obtain simultaneously up to 10-15 eigenvalues and eigenvectors. The described program packet differs from the existing ones by a wider statement of boundary problems of electrodynamics and by methods used for their solution. This allows to improve accuracy and efficiency of the analysis of accelerating structure properties.

9731 (INIS-SU—369, pp 25-29) **Magnetic field correction systems for the IHEP cyclic injector.** Bruk, V.L.; Vorob'ev, V.K.; Gurevich, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Magnetic field correction system for the IHEP cyclic injector is described. The system consists of 22 special correction magnets as well as additional windings of focusing defocusing units of a main magnet which control betatron oscillation frequencies. Correction magnet structure is shown. Control program provides such current distribution among correction windings when independence of separate resonance bands correction is preserved in the tuning process. A block diagram for controlling correction system power supply is given. Correction system control equipment provides: control of the laws of current change in dynamic power supplies; possibility of power supply operation in two different regimes during one booster pulse burst (pulse-to-pulse modulation regime); control of power supply currents; control of power supply condition.

9732 (INIS-SU—369, pp 403-406) **Long-term retaining of circulating beam on relativistic orbit in the Trol synchrotron.** Anevskij, S.I.; Varnyj, A.E.; Enbaev, A.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Optiko-Fizicheskikh Izmerenij, Moscow, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

An experimental facility for studying the process of the particle transport on the relativistic orbit in a composite magnetic field for its longterm retaining on the basis of the "Trol" synchrotron is considered. The facility parameters allow it to serve as a synchrotron radiation source in the far infrared and submillimeter wave length range. The 1.4 T guiding magnetic field is formed by the two fields-constant and variable-superposition. The facility consists of electromagnet with iron core, into which a block is placed which contains two-loop electromagnet-solenoid which in turn is at the same time theaccelerating field SHF standing wave resonator. The accelerator glass chamber is at the same time the synchrotron radiation channel. The measurements have shown that the number of particles in the beam makes up 10^8. The beam energy at the 17 mm orbit radius equals to 7 MeV. The synchrotron radiation sourse power is 10sup(-5)-10sup(-3) W.

9733 (LA-UR—86-3761) **What is the most efficient high-energy accelerator.** Channell, P.J. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 12p. (CONF-8608123—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002924.

From Advanced accelerator concepts conference; Madison, WI, USA (21 Aug 1986).

The accelerator configuration that will result in the largest fraction of accelerator kinetic energy transferred to accelerated particles is explicitly determined from general principles.

9734 **(LAL-RT—86-02) Polarization in electron and proton beams.** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1986. 44p. (CONF-8509330—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750746.

From CERN accelerator school; Oxford, UK (16 Sep 1985).

One first introduces the concept of polarization for spin 1/2 particle beams and discusses properties of spin kinetics in a stationary magnetic field. Then the acceleration of polarized protons in synchrotrons is studied with emphasis on depolarization when resonances are crossed and on the cures for reducing it. Finally, transverse polarization of electrons in storage rings is discussed as an equilibrium between polarizing and depolarizing effects of synchrotron radiation. Means for obtaining longitudinal polarization are also treated.

9735 **(LBL—21292) Magnetic field measurements of model SSC [Superconducting Super Collider] dipoles.** Hassenzahl, W.V.; Gilbert, W.S.; Green, M.I.; Barale, P.J. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 6p. (CONF-860914—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002547.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

To qualify for use in the Superconducting Super Collider, the 8000 or so 16 m long dipole magnets must pass a series of tests. One of these will be a set of warm measurements of field quality, which must be precise to about 0.001% of the 100 G field produced by 10 A, the maximum current the coils are allowed to carry for an extended period at room temperature. Field measurements of better than this accuracy have already been carried out on 1 m long model dipoles. These measurements have included determinations of the dipole fields and the higher harmonics in the central or two dimensional region and in the total magnet. In addition, axial scans of the dipole and higher harmonic magnetic fields have been made to determine the local variations, which might reflect fabrication and assembly tolerances. This paper describes the equipment developed for these measurements, the results of a representative set of measurements of the central and integral fields and axial scans, and a comparison between warm and cold measurements. Reproducibility, accuracy and precision will be described for some of the measurements. The significance of the warm measurements as a part of the certification process for the SSC dipoles will be discussed.

9736 **(SLAC-CN—339) Single pass collider memo: Dispersive effects of orbit errors in the SLC arcs.** Weng, W.; Sands, M. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 14 Nov 1986. Contract AC03-76SF00515. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003223.

An analytical attempt is made to estimate the perturbations of eta-functions after orbit correction of the SLC arcs. Emphasis is on the effects caused by the orbit errors created by misalignments. It is shown that the 'non-dispersive' property of a 'magnet mover' is not true whenever the vertical off-energy function is non-zero. The north arc is used as an example for numerical calculation. (LEW)

9737 **(SLAC-PUB—4073) The principles and construction of linear colliders.** Rees, J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1986. Contract AC03-76SF00515. 24p. (CONF-860650—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002995.

From NATO advanced study institute on techniques and concepts of high energy physics; St. Croix, Virgin Islands, U.S. (19 Jun 1986).

The problems posed to the designers and builders of high-energy linear colliders are discussed. Scaling laws of linear colliders are considered. The problem of attainment of small interaction areas is addressed. The physics of damping rings, which are designed to condense beam bunches in phase space, is discussed. The effect of wake fields on a particle bunch in a linac, particularly the conventional disk-loaded microwave linac structures, are discussed, as well as ways of dealing with those effects. Finally, the SLAC Linear Collider is described. 18 refs., 17 figs. (LEW)

9738 **Passive control of high-energy high-current $\nu/\gamma \geq 1$ HERMES III beam.** Sanford, T.W.L.; Halbleib, J.A.; Poukey, J.W.; Wright, T.P.; Heath, C.E.; Spence, P.W.; Kishi, J.; Fockler, J. (Sandia National Labs., Albuquerque, NM). pp 45 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). Contract AC04-76DP00789.

HERMES III is a 20 MV 500-800 kA linear induction electron accelerator being designed for use as a large area uniform source of flash γ-rays. At the exit of HERMES III a diode is placed, which converts the electrical energy to bremsstrahlung radiation. 2-D simulations of electron flow in the anode-cathode gap of the diode, when using a planar diode-converter, indicate that the beam forms a weak pinch that can be described by a mean pinch angle, Θ, that is dependent on the diode impedance, Z, and voltage, V, through an empirical relation. For HERMES III parameters, Θ varies between 33° and 47°, which results in excessive on-axis radiation. This paper discusses a modification to the anode that reduces Θ and results in substantially improved radiation uniformity.

9739 **The operation of a post-acceleration gap on Pulselac.** Johnson, D.J.; Lockner, T.R. (Sandia National Labs., Albuquerque, NM 87185). pp 45 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). Contract AC04-76DP00789.

It was shown that the accelerating electric field can be used to steer the beam. This was accomplished by moving the inner coils and electrodes in the axial direction to tilt the gap. It was also shown that the electric field can be used to focus the beam. This was accomplished by moving the gap electrodes up- and downstream with the coil positions fixed. This demonstrated that the magnetic field lines serve to define the equipotentials in the gap. Details of these measurements are presented along with a comparison to expected beam deflections.

9740 **Ion-focused transport of relativistic electron beams.** Shope, S.L.; Frost, C.A.; Ekdahl, C.A.; Freeman, J.R.; Hasti, D.E.; Leifeste, G.T.; Mazarakis, M.G.; Miller, R.B.; Poukey, J.W.; Tucker, W.K. (Sandia National Labs., Albuquerque, NM 87185). pp 46 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). Contract AC04-76DP00789.

An ionized channel in a low pressure gas can be used to electrostatically guide a high-current, relativistic, electron beam. Low-energy electrons confined and guided by a weak longitudinal magnetic field were used to form the ionized channel. This technique was used to transport a rotating 20 kA beam for a distance of 16 m. Beam losses due to emittance-driven erosion only occur during the first two meters of transport, as predicted, and the resulting pulse was efficiently transported the remaining distance. The authors also used this method to perform experiments that demonstrated efficient guiding of a high-energy, 25-kA, beam around a 90° curved sector. No increase of beam radius was expected or observed, demonstrating that emittance growth is within acceptable limits for application to the Sandia Recirculating Linear Accelerator. Initial experiments with the recirculating accelerator injector have demonstrated efficient transport of a 1-MeV, 30-kA beam for more than 1 m.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 9664, 9665, 9731, 9740, 9777, 9842, 9843, 10191, 10211, 10216

9741 **(BNL—28073-Rev.A) Requirements and guidelines for NSLS experimental beam line vacuum systems: Revision A.** Foerster, C.; Halama, H.; Thomlinson, W. (Brookhaven National Lab., Upton, NY (USA)). Oct 1986. Contract AC02-76CH00016. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003206.

Requirements are provided for NSLS beam line front ends and vacuum interlocks. Guidelines are provided for UHV beam line vacuum systems, including materials, vacuum hardware (pumps, valves, and flanges), acoustic delay lines and beam line fast valves, instrumentation, fabrication and testing, and the NSLS cleaning facility. Also discussed are the design review for experimenters' equipment that would be connected to the NSLS and acceptance tests for any beam line to be connected with the ring vacuum. Also appended are a description of the acoustic delay line as well as the NSLS vacuum standards and NSLS procedures. (LEW)

9742 **(BNL—38035) NSLS 3: Conceptual design report: 750 MeV e^+ or e^- injector.** (Brookhaven National Lab., Upton, NY (USA)). May 1986. Contract AC02-76CH00016. 368p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE87003191.

The 750 MeV positron or electron injector is comprised of an electron linear accelerator which accelerates an intense beam of electrons to an energy of about 250 MeV, a positron converter, a second linear accelerator that boosts the final positron energy to 750 MeV, and a damping ring in which radiation damping is used to reduce the emittance of the positron beam for injection into the storage rings. The reasons for the need of a new injector are enumerated. The conceptual design of the system and its component systems are described, as well as project cost, schedule, and manpower requirements. (LEW)

9743 **(BNL—38824) Introduction to the theory of free electron lasers.** Krinsky, S. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 29p. (CONF-850771—8). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002392.

From SLAC summer school on the physics of high energy particle accelerators; Stanford, CA, USA (15 Jul 1985).

We present an introduction to some fundamental aspects of the theory of free electron lasers. Spontaneous radiation emitted by electrons traversing a wiggler magnet is briefly reviewed, and stimulated emission in the low-gain regime is discussed using Colson's pendulum equations and Madey's theorems. The high-gain regime is treated by an extention of the work of Bonifacio, Pellegrini, and Narducci. We introduce dynamical variables to describe the radiation field, and a Hamiltonian formulation of Maxwell's equations is employed. A canonical transformation to the interaction representation factors out the fast time variation of the radiation field, and the slow time dependence is determined by linearized equations for the appropriate collective variables. As an application of this technique we consider self-amplified spontaneous radiation, and we comment upon the relationship between our approach and the use of coupled Vlasov-Maxwell equations.

9744 **(BNL—38856) Results using active quench protection strip heaters on a Reference Design D SSC dipole magnet.** Ganetis, G.; Prodell, A. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 4p. (CONF-860914—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003211.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

Measurements were made with a Reference Design D SSC dipole magnet to study the quench behavior of the magnet when active quench protections trip heaters were used to initiate quenches. The magnet has a 2-layer cosine θ coil configuration with a bore diameter of 4 cm and a length of 4.5 m. The strip heaters, their arrangement and installation are described. Three strip heaters individually and in combinations were used during these studies in the first series of which the magnet current was set at that value for which the quantity integral I^2 dt was maximum. A capacitor was discharged through the strip heater with the charging voltage being increased progressively until a magnet quench was initiated. The time interval between when the voltage was applied to the strip heater and when the magnet quench began was measured as was the time required for the voltage across the magnet coil that had quenched to reach 3V. These times and the quantity integral I^2 dt are presented for several values of charging voltage for different heaters and combinations of heaters. Curves of these times and integral I^2 dt as a function of magnet current at constant capacitance and voltage are also shown.

9745 **(CAPE—2988) SLAC klystron drawings (Engineering Materials).** (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 1 Jul 1986. Contract AC03-76SF00515. OSTI, PO Bx 62, Oak Ridge, TN 37831. File Number TI87000851.

These drawings provide engineering details on sub-assemblies of the SLAC 5045 klystron high power microwave amplifier.

9746 **(CNEA-NT—13/85) Ion beam intensity for an electrostatic accelerator as a function of their charge state and terminal voltage.** Etchegoyen, A.; Fernandez Niello, J.O.; Pacheco, A.J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Investigaciones). 1985. 58p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700277.

A set of plots with relative percent intensities for different beam charge states is displayed as a function of the terminal voltage. Either a solid ^{12}C stripper or some gaseous strippers are supposed. The charge state distributions were obtained from the empirical formula proposed by Sayer. The main aim of these plots is to choose a charge state-terminal voltage set in order to maximise the beam intensity for a given bombarding energy.

9747 **(CONF-861114—31) Emittance studies of high intensity negative ion sources equipped with continuous surface cylindrical and spherical geometry tungsten ionizers.** Alton, G.D.; McConnell, J.W.; Tajima, S.; Nelson, G.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003011.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

A digitally controlled emittance measurement, data acquisition and processing system has been designed, implemented and used to determine emittances of negative ion beams extracted from high-intensity negative-ion sources equipped with cylindrical and spherical geometry cesium surface ionizers. Comparative studies indicate that the emittances of ion beams extracted from the source equipped with a spherical geometry ionizer are lower by 13% to 21% than those extracted from the source equipped with a cylindrical geometry ionizer. This difference may be attributable to geometric factors rather than differences in the sizes of the emission areas at the points of negative-ion generation. Studies reveal that the emittances of these sources are independent of ion mass for most of the materials investigated and independent of ion current over the range of ion currents used in these investigations (4μA to 12 μA).

9748 **(FNAL/C—86/124) Stochastic cooling at Fermilab.** Marriner, J. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1986. Contract AC02-76CH03000. 8p. (CONF-860870—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002213.

From 13. international conference on high energy accelerators; Novosibirsk, USSR (7 Aug 1986).

The topics discussed are the stochastic cooling systems in use at Fermilab and some of the techniques that have been employed to meet the particular requirements of the anti-proton source. Stochastic cooling at Fermilab became of paramount importance about 5 years ago when the anti-proton source group at Fermilab abandoned the electron cooling ring in favor of a high flux anti-proton source which relied solely on stochastic cooling to achieve the phase space densities necessary for colliding proton and anti-proton beams. The Fermilab systems have constituted a substantial advance in the techniques of cooling including: large pickup arrays operating at microwave frequencies, extensive use of cryogenic techniques to reduce thermal noise, super-conducting notch filters, and the development of tools for controlling and for accurately phasing the system.

9749 **(INIS-SU—352, pp 377-380) Results of test operation of the thyristor power supply for the BU-70 proton synchrotron ring electromagnet.** Vasil'ev, S.N.; Gusev, G.I.; Dan'shin, V.P.; Eliseenko, A.I. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad, USSR; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE87780023. (CONF-8410203—Vol.1).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

The thyristor converter put into operation in the course of reconstruction of the power supply of the BU-70 synchrotron ring electromagnet is described. The converter is designed for maximum current I=5 kA and voltage 2 x 10 kV and consists of four three-phase bridge rectifiers connected in parallel in the equivalent twelve-phase circuit. The total number of thyristors - 2304. The thyristor power supply operated over 7000 h. The conclusion is drawn that the use of thyristors allows one to sharply reduce the time of system tuning for nominal operation mode, reduce water consumption for convertercooling and considerably improve the working conditions ofthe maintenance personnel.

9750 **(INIS-SU—369, pp 134-137) Development and organization of isotope production on the U-240 cyclotron for medical and biological applications.** Ageev, V.A.; Belyavenko, V.S.; Bykov, V.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij; Joint Inst. for Nuclear Research, Dubna, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

A description of production process of iodine-123 of high rationuclide purity in quantaties enough for medico-biological investigations on the U-240 cyclotron is presented. U-240 isochronous cyclotron permits acceleration of protons up to 80 MeV and deutrons up to 70 MeV. The ^{127}I(p, 5n)^{123}Xe → ^{123}I → ^{123}Te reaction has been used to produce ^{123}I. A target device is described. Sodium iodide has been used as a target material. In order to determine a dependence of ^{123}Xe yield on the energy of protons incident on the target the pellets of 1.0 mm (2-3 MeV) have been used, and for production of large quantaties of ^{123}I the pallets of the thickness from 7 to 10 mm have been used. Irradiation have been carried out with currents up to 10 μA. The accumulated iodine-123 was 4-5 μCi/μA hour.

9751 **(IPNO-GEPL—83-08) Particle beam extraction at the Orsay cryogenic coil cyclotron.** Martin, E. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 29p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750764.

We are presenting the design and the performance of the single turn extraction in the Orsay cryogenic cyclotron. After a careful shaping of the average magnetic field in the extraction area for a representative set of particles, we get the various expected corresponding νsub(r) (νsub(s)) diagrams and then the corrected diagram of the kinetic energy per nucleon T at the exit vs Z/A. The study of the accelerated orbits till the entrance in the extraction devices shows the turn separation is sufficient to allow the insertion of an electrostatic septum and satisfying energies and RF phases are obtained. The designed extraction devices are successively: an electrostatic deflector, located in a hill, with an electric field 100 kV/cm, an iron free channel, located in the following hill, having to produce a field drop 0.25 T, some magnetostatic channels for radial focusing. A quick look at the technological features of the electromagnetic channel is given proving its possibility.

9752 **(Juel—2048) On the realization of a proton-window for a spallation breeder with 300 MW beam power.** Seidel, C. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Mar 1986. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750310.

The pebble bed target is considered as an alternative to the rotating target of a spallation neutron source. In this case the proton beam has to pass through a 'window' into the spallation breeder. For this window several materials and divers constructive alternatives are investigated. After the final determination of the different parameters a detailed analysis concerning stability, temperatures and stresses as well as the behaviour under proton irradiation follows. From these considerations an estimation at the maximum operation time is deduced. The window is formed as a hemisphere, whose curvature shows to the high pressure side. It consists of silicon infiltered silicon carbide. Water is used as cooling fluid. It is conducted through a second spherical shell which is arranged at the vacuum side of the window. The investigations predict a lifetime of about 200 h.

9753 (KEK—84-2) **Operation of a superthermal ultracold neutron converter.** Yoshiki, H. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Apr 1984. 28p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700278.

At the end of the last February, the ultra-cold neutron generator Mark 280 using a superfluidity helium converter was continuously operated for 60 hours maintaining the superfluidity helium of 1.5 l at 0.55 deg K as prescribed. This equipment was designed so as to remove automatically with high accuracy He-3 of 1.4×10^{-7} as an impurity with a contained superleak, and the operation can be carried out continuously. This research aimed at the generation and accumulation of ultra-cold neutrons used for the measurement of the electric dipole efficiency of neutrons. So far, the development of a special detector for ultra-cold neutrons, the tracking of H, OH and H_2O adhering to the walls of accumulating cavities, the research on the effect of glow discharge, the glow discharge in D_2 atmosphere and the loading of D_2O, and the research and development of a cryostat have been carried out. The outline and the features of the equipment, the method of precooling, the operation of the equipment such as the start-up, the things to be done during measurement, helium consumption and the shutdown are reported.

9754 (KEK—84-14, pp 275-290) **Examples of international cooperation on superconducting magnets R and D in high energy physics.** Hirabayashi, H. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

There are several cases of international cooperation in the field of superconducting magnet technology in high energy physics. For instance, the Saclay-Serpukhov cooperation on accelerator magnet development and the co-operative work on magnets between CERN and European countries have been known. In general, international cooperation is useful for mutual information exchange on topics, the efficient utilization of manpower and experimental facilities, and competitive development among countries or regions. In this report, three examples of the Japan-US cooperation on superconducting magnet R and D in high energy physics and their extended development in Japan are briefly described. In cooperation with Fermilab and National Research Institute for Metals, Japan, KEK has made a series of basic studies on binary and ternary alloy superconducting wires for high field magnets, such as Nb-Ti and Nb-Ti-Ta alloys. Since 1981, KEK and BNL have carried out the cooperative studies on the basic properties of Nb_3Sn superconducting wires. Prior to the construction of the COF solenoid now being built by Tsukuba University and Fermilab, a prototype superconducting solenoid was develped by embedding NbTi/Cu wires in aluminum strips.

9755 (KEK—85-5, pp 314-329) **CDF muon detection.** Pondrom, L.G. (Wisconsin Univ., Madison, USA). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The muon detection system now being constructed for CDF is briefly described. This system is composed of magnetized iron toroids covering the polar angle range $3^\circ <$ theta $< 17^\circ$ with respect to both circulating p's and anti p's, and a central muon detector covering +- 35° about 90° to the beams. Muons above about 3 GeV/c psub(perpendicular) are identified at the trigger level by requiring tracks to be straight within the spatial resolution of the trigger hardware and to penetrate 6 lambdasub(a) or more of Fe. At the trigger level the rate is dominated by $\pi \rightarrow \mu$ decays in flight. An initial trigger rate at 10^{30} cm^{-2} sec^{-1} luminosity of 100 hz for single muons can be decreased to a few hz by using more complete fast pattern recognition. Proposed enhancement of the muon coverage as a part of the detector upgrade is also described.

9756 (KEK—85-5, pp 254-273) **Improvement programme of the UA2 detector.** Gaillard, J.M. (Paris-11 Univ., 91 - Orasy, France. Lab. de l'Accelerateur Lineaire). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The UA2 experiment took its first data in November 1981 and has been operating smoothly since then. After a long shutdown in 1986, the Sp anti pS collider will resume operation with a substantially higher luminosity than presently available. The recently approved Antiproton Collector should allow for a total integrated luminosity of nearly 10 pb^{-1} by the end of 1989. In order to make the best use of the increased luminosity in terms of physics results the performance of the present UA2 detector has to be simultaneously improved. In this report, discussions are made concerning calorimeter end caps, upgraded vertex detector, as well as end cap tracking and preshower. It is concluded that the new design results from a number of choices dictated by the following considerations: i) The upgraded UA2 must be operational in 1987, as soon as the Collider resumes operation, in order to maximise its physics output during the period when TEV 1, with nearly three times as high a c.m. energy, has not yet taken over leadership. ii) The upgraded UA2 must remain competitive on the major physics issues rather than diversify its detection capabilities. iii) Priority is given to the quality of the missing transverse energy measurement. iv) Modifications to the vertex detector aim at ensuring that multivertex events can be reconstructed and at improving the detector performance in relation with electron identification.

9757 (KEK—85-5, pp 275-292) **Collider detector at Fermilab-CDF. A progress report.** Theriot, D. (Fermi National Accelerator Lab., Batavia, IL, USA). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The current situation of CDF, the Collider Detector at Fermilab, is presented in this report. The primary physics goal for CDF is to study the general features of proton-antiproton collisions at 2 TeV center-of-mass energy. On general grounds, it is expected that parton subenergies in the range 50 - 500 GeV will provide the most interesting physics at this energy. The detector is divided into three main parts, the central detector and two forward/backward detectors. All three parts, when running, are centered on the Tevatron beamline at the B0 collision area. In particular, the structure of the central detector is described in detail in this report. The multilevel trigger and the B0 experimental area which are planned for CDF are also described. The current Fermilab schedule has CDF scheduled for three runs with antiprotons in the near future. The first run, which will mainly serve as a systems test, is expected to be performed in August or September 1985. After that, Fermilab will go into a long construction shutdown. A second run is scheduled for the summer of 1986. At that time CDF is expected to be approximately 95 % complete. And in the fall of 1986 the first physics run is scheduled for three months duration.

9758 (KEK—85-5, pp 293-300) **CDF superconducting solenoid.** Mori, Shigeki. (Tsukuba Univ., Sakura, Ibaraki, Japan. Inst. of Applied Physics). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

A thin superconducting solenoid for the Fermilab Collider Detector Facility was constructed. A superconducting coil consists of a single layer helical winding of aluminum-stabilized NbTi/Cu superconductor of 1164 turns. The solenoid utilizes the forced flow cooling method of two phase helium and does not possess a permanent inner bobbin. The radially outward magnetic forces are supported with an aluminum-alloy cylinder inside which the coil is mounted with the shrink-fit assembly. Initial tests, including induced quench tests and a warm-up test, were carried out. The maximum excitation current was limitted to 2800 A. The results of the tests revealed the excellent thermal stability of the CDF solenoid. It is remarkable that the solenoid with the forced flow cooling system did not quench for a heater input of 10 kJ. This thermal stability may be due to the following reasons: (a) good quality of the aluminum stabilized NbTi/Cu superconductor with the EFT method, (b) the shrink-fit assembly of the coil and support cylinder, (c) the mechanical structure of the coil without having a permanent inner bobbin, (d) the arrangement of the cooling tubes which were welded to the outer support cylinder, and (e) the good design of the cryostat.

9759 (KEK—85-5, pp 301-313) **Physics with CDF small angle spectrometer.** Focardi, E. (Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The CDF small angle spectrometer is aimed at accomplishing such physics goals as 1) measurement of the elastic scattering differential cross section, 2) measurement of the total cross section and of the machine luminosity, 3) measurement of the differential cross section for proton single diffraction dissociation anti pp → anti pM, 4) search for special events associated with high mass diffraction dissociation, and 5) study of the double-pomeron process anti pp → anti ppM. The detector is made out of 26 silicon detectors placed in seven stations along the beam line. Three different types of silicon wafers are foreseen for two different types of insertions. The latter half of this report is dedicated to a description of how each measurement will be performed by using this detector. Measurements 1), 2) and 3) will be performed with the Collider operating at high β; thus smaller scattering angles and smaller t-values will be reachable. Some aspects of the double Pomeron process can also be measured in the high β operating node. Elastic scattering in the t region between 0.4 and 2 $(GeV/c)^2$ and a search for diffractively produced large mass special events will be done at low β to take advantage of the increased machine luminosity and the longer running time.

9760 (KEK—85-5, pp 330-348) **Heavy flavour tagging in CDF.** Menzione, A. (Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

This contribution is focussed on the physical importance of secondary vertices recognition in the search for rare events with heavy flavour content. A description of the system foreseen for CDF and an outline of its features are given. In particular, a discussion is made concerning the improvements in a number of quality factors of the detector, other than vertex tagging, which are obtained through the implementation of the vertex detector. Based on detailed simulations, examples are given which illustrate the effectivencess of the system to reject gackground from light quark events. Efficiencies expected for a number of channels of physical importance are quoted. As a result of these considerations, it is concluded that the use of silicon crystals enables realization of a detector capable of seeing secondary vertices of particles decaying with lifetimes greater than 10^{-13} sec. The determination of these vertices groups the tracks in bundles thus helping in understanding the decay chain. Overall figures of merit of CDF improve by important factors, e.g. $\Delta Pt/Pt$ improves by a factor two. A search for new rare events in hadron channels may become feasible with the SVX, while being impossible without it.

9761 **(KEK—85-7) Performance of the EXAFS beam line at Photon Factory.** Nomura, Masaharu. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Aug 1985. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700279.

Performance of the EXAFS spectrometer installed at BL10B branch beam line has been tested. More than ~10^8 photons/s in 7 ~ 20 keV energy region pass through a rectangular aperture 7 mm wide and 1 mm high when the storage ring is operated at 2.5 GeV energy and 100 mA current. Effect of an impurity in a sample cannot be neglected when its absorption edge exists in the EXAFS region of the sample. Degradation of EXAFS wiggle due to higher-harmonics can be minimized by changing the thickness of the sample and by selecting appropriate detection gas.

9762 **(LA-UR—86-3985) Optimized design of free-electron lasers.** Brau, C.A. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 28p. (CONF-8609131—8). NTIS, PC A03/MF A01; GPO Dep. File Number DE87002898.

From 8. international free electron laser conference; Glasgow, UK (1 Sep 1986).

In the design of free-electron lasers, a large number of parameters must be traded off against one another to maximize the performance subject to a variety of constraints. Two examples are considered. In the first it is desired to maximize the gain for a given wavelength, subject to constraints on the electron-beam peak current and energy. In the second example, it is desired to maximize the efficiency for a given wavelength and power, subject to the constraints imposed by mirror damage and optical resonator alignment.

9763 **(LBL—21230) Evaluation of various fabrication techniques for fabrication of fine filament NbTi superconductors.** Scanlan, R.M.; Royet, J.; Hannaford, R. (Lawrence Berkeley Lab., CA (USA)). Sep 1986. Contract AC03-76SF00098. 9p. (CONF-860914—17). NTIS, PC A02. File Number DE87002571.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

The successful fabrication of a fine filament high current density NbTi superconductor can have a significant impact on the cost of the Superconducting Supercollider. Consequently, we have been exploring various approaches for fabricating this type of superconductor, in collaboration with several superconductor wire manufacturers. The techniques investigated include double conventional hot extrusion, large single stack conventional hot extrusion, large single stack conventional hot extrusion, and warm hydrostatic extrusion. The important conductor properties (critical current density, piece length, yield, and cost) will be compared for the various approaches. Finally, the feasibility of manufacturing production quantities of a fine filament conductor will be assessed.

9764 **(LBL—21297) Development of a 40 mm bore magnet cross section with high field uniformity for the 6.6T SSC dipole.** Caspi, S.; Gilbert, W.; Helm, M.; Laslett, L.J.; Taylor, C. (Lawrence Berkeley Lab., CA (USA)). Sep 1986. Contract AC03-76SF00098. 8p. (CONF-860914—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002572.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

The SSC requires a very uniform dipole field. A 40 mm bore diameter winding cross section has been developed which has computed multipole coefficients less than 1 x 10^{-6} of the dipole field at 10 mm radius for an operating field of 6.6T at 4.35 K. This cross section has 4 conductor blocks (3 wedges, 16 turns) per quadrant in the inner layer, and two blocks (1 wedge, 20 turns) in the outer layer. "Partially keystoned" cable is used; the inner cable has 23 strands of .0318 inch diameter wire; the outer cable has 30 strands of .0255 inch diameter wire. Model magnets have been constructed and the fields measured at room temperature and at liquid helium temperature up to fields exceeding 6.6T. Measured fields are compared to the predicted field. In addition, the as-built conductor positions in several magnets have been determined after cutting up the magnets. The predictions based on as-built configurations are computed and compared to measurements.

9765 **(NP—7900275) The SIN[Swiss Institute for Nuclear Research]-neutron source: Status report.** Atchison, F.; Fischer, W.E.; Pepin, M.; Renker, D.; Takeda, Y.; Tschalaer, C. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). Jul 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900275.

SINQ is a continuous spallation neutron source which is planned to be attached to the existing accelerator at SIN after its upgrading to higher currents. The overall project aims to provide the Swiss neutron user community with the facilities necessary to carry out scattering experiments in the wavelength range 1 to 10 A; that is, the neutron source itself, experimental areas, sample conditioning apparatus, sample preparation areas and scattering instruments. Construction is planned to start in 1987, with the first neutron expected in early 1990. Total costs (excluding spectrometers) are estimated to be 27 Mio. SFr.

9766 **(SAND—86-1582C) B/sub θ/-lens diode for HERMES III.** Sanford, T.W.L.; Poukey, J.W.; Halbleib, J.A.; Bailey, V.L.; Proulx, G.; Spence, P.W. (Sandia National Labs., Albuquerque, NM (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). 1986. Contract AC04-76DP00789. 18p. (CONF-861110—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002486.

From American Physical Society Plasma Physics Division meeting; Baltimore, MD, USA (3 Nov 1986).

Two promising options for a diode configuration that could give the radiation dose uniformity required for HERMES III have been identified. The first option employs an indented anode to passively control the beam at the converter. Simulations indicate that the desired uniformity can be achieved, but only with a current loss of 10% to 50%. This paper discusses a second option that avoids the current loss by employing both a gas cell and an external current-carrying conical converter to generate a B/sub θ/ field to control the beam. The "B/sub θ/ lens" concept has the additional advantage that: (1) the radiation pattern can be controlled by varying the external current; (2) the lens prevents low energy electrons associated with the leading and trailing edge of the voltage pulse from reaching the converter thus helping to sharpen the risetime of the radiation pulse; and (3) the lens acts as an energy spectrometer providing diagnostic information. Simulations of a prototype diode being fielded on the 3 MV 16 Ω helia accelerator will be discussed.

9767 **(SLAC-PUB—4111) The SLAC lasertron project.** Sinclair, C.K. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 15p. (CONF-8608123—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003262.

From Advanced accelerator concepts conference; Madison, WI, USA (21 Aug 1986).

SLAC has a program underway to develop an efficient high power microwave source for accelerator applications employing a photoemission cathode, the so-called lasertron. After a brief discussion of the lasertron idea, the various elements of the current program are reviewed. A proof-of-principle experiment to build a 35 MW, 70% efficiency, S-band microwave source is nearing completion. Actual RF power testing is expected to begin in late 1986 or early 1987.

9768 **(TRI-PP—86-69) Recent developments of the TRIUMF cyclotron as an H^- injector for the KAON Factory.** Dutto, G. (TRIUMF, Vancouver, British Columbia (Canada)). Aug 1986. 7p. (CONF-860870—16). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900097.

From 13. international conference on high energy accelerators; Novosibirsk, USSR (7 Aug 1986).

The TRIUMF facility is presently based mainly on the 500 MeV H^- cyclotron delivering simultaneous proton beams up to 200 μA intensity to various users. Recently a proposal for a KAON Factory facility has been submitted where the H^- cyclotron is to be used as an injector. This has to be modified to allow direct extraction of a $\geqq$ 100 μA H^- beam. A feasibility study has been performed and shows that direct H^- extraction from the cyclotron is indeed possible with an efficiency greater than 90%. Experimental evidence of this will be presented. Other modifications for beam quality, beam intensity and reliability are introduced in the 500 MeV cyclotron progressively in line with the high level of performance required from the cyclotron. These will be briefly discussed.

9769 **(TRI-PP—86-95) Extraction exploiting nu/sub r/ = 3/2: Optical and technical constraints on performance.** Laxdal, R.E.; Zach, M.; De Vita, E.; Dutto, G.; Mackenzie, G.H.; Pearson, J.; Richardson, J.R. (TRIUMF, Vancouver, British Columbia (Canada)). Oct 1986. 4p. (CONF-8610173—7). NTIS (US Sales Only), PC A02. File Number DE87900311.

From 11. conference on cyclotrons and their applications; Tokyo, Japan (13 Oct 1986).

A demonstration of the feasibility of directly extracting 100 μA of 450 MeV H^- ions is under way at the TRIUMF cyclotron. The existing turn density must be reduced to achieve an extraction efficiency of >90%. The chain of extraction elements consists first of an 11.5 MHz rf deflector placed at the nu/sub r/=3/2 resonance to excite a coherent radial oscillation. Then an electrostatic deflector with a positive voltage is placed at a radius, about 100 turns later, where precession generates a large radius gain per turn. This is followed by a second electrostatic deflector and three or four magnetic channels. A pair of additional 92 MHz rf cavities will triple the radius gain per turn, improving extraction efficiency and reducing electromagnetic stripping loss for proton extraction. The number and position of the extraction elements is primarily dictated by beam dynamics considerations. Near nu/sub r/=3/2 the orbit of the deflected H^- beam makes three radial oscillations over two turns and the first channel must be placed near a peak in the outward swings. The rf deflector perturbs the circulating orbits reducing and shifting the peaks in separation generated by the electrostatic deflectors. Practical limitations on element strengths and the fringe fields of the magnetic channels impose further restrictions. Finally the location of existing equipment and of existing extraction ports has also to be taken into account. A suitable layout of the extraction elements, as well as experimental testing to date and plans for the future, will all be presented.

9770 **(TRI-PP—86-106) Extraction of H^- ions from a dc cusp source.** Yuan, D.H.; Baartman, R.; Kendall, K.R.; McDonald, M.; Mosscrop, D.R.; Schmor, P.W. (TRIUMF, Vancouver, British Columbia (Canada)). Oct 1986. 5p. (CONF-8610115—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900305.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

Recent investigations have concentrated on the parameters affecting the quality of the H^- beam from a newly developed dc volume multicusp ion source with a single-stage-post-acceleration (SSPA) extraction system for injection into the TRIUMF cyclotron. The experimental results indicate that the beam emittance is nearly independent of the arc current in the range of 10 A to 40A. Also described are modifications to the extraction system which have significantly reduced the electron contamination in the H^- beam.

9771 **Volume production of negative hydrogen and deuterium ions in a reflex-type ion source.** Jimbo, K.; Ehlers, K.W.; Leung, K.N.; Pyle, R.V. (Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **248**: No. 2/3, 282-286(1 Aug 1986). Contract AC03-76SF00098.

The extraction of negative and positive hydrogen and deuterium ions from a reflex-type negative ion source has been investigated. Extracted positive and negative ion currents were measured as functions of the gas flow rate, the axial magnetic field, and the bias potential of the cylindrical wall of the arc-chamber. By biasing the cylindrical wall several volts negative relative to the anode, a maximum H^- current of 9.7 mA (J^- approx. = 100 mA/cm^2) and D^- current of 4.1 mA (J^- approx. = 42 mA/cm^2) were obtained in steady state operation. This result shows a factor of two improvement over previous data. The total impurity negative ion content was less than 1%. When the source was arranged for positive ion extraction, a high proton ratio (90%) was observed. The extracted negative ion current was approximately as large as the positive ion current.

9772 **New method for injecting charged particles across a magnetic field.** Morris, D.E. (Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **248**: No. 2/3, 297-300(1 Aug 1986).

A new method is described for injecting charged particles across a magnetic field, in which an electrostatic reflector (bouncer) reverses the direction of the ions after they travel around a half orbit in the magnetic field. This method can be used for radial injection of charged particles into a cyclotron, or possibly into a plasma confined by a magnetic field.

9773 **Klystrons and lasertrons.** Konrad, G.T. (Stanford Linear Accelerator Center). pp 70 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—).

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

High power klystron development at SLAC is described. This includes pulsed klystrons for linacs and CW klystrons for storage rings. One of the recent pulsed tubes has 150 MW peak RF power output and an RF pulse length of 1 microsec. The operating voltage is 475 KV and 650 A. Another pulsed tube, which is currently in large-scale production for the SLAC linear collider, is a 50 MW klystron with an RF pulse length of 5 microsec, an operating voltage of 315 KV and a current of 354 A. The DC to RF conversion efficiency of this tube is approximately 47 percent. A method to increase this number is described. It involves the use of a double gap output cavity. Experience with high voltage and RF window performance is discussed. R & D work on double windows, BeO windows and multipactor suppressing coatings is also described. The pulsed tubes operate at 2856 MHz, which is the SLAC linac frequency. A high power CW klystron operating in the UHF (353 MHz) is described. This tube is used in the PEP storage ring at SLAC and puts out 500 KW CW. The operating voltage is 63 KV and the microperveance is 0.75. The best efficiency on this tube is 65 percent. This was achieved by use of a second harmonic cavity. Twelve such tubes are in operation and the MTBF is over 20,000 Hours.

9774 **High power klystrons and lasertrons.** Konrad, G.T. (Stanford Linear Accelerator Center). pp 82 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—).

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

Recent developments on high power sources at SLAC are described. High power klystrons have been under development for many years. The two most recent tubes are a 150 MW klystron operating at an RF pulse length of 1 microsec and a 50 MW klystron operating at 5 microsec. The latter is the tube used for the SLAC linear collider. All work discussed in this paper was done at a frequency of 2856 MHz, the linear accelerator frequency. Design criteria and operating experience for both of these tubes are described. Several computer codes exist for calculating the performance of proposed designs. Problem areas encountered were with high voltage breakdown in the 300 to 500 KV range, window failures and RF instabilities. Window R & D has concentrated on dual output windows, BeO and multipactor suppressing coatings. The tubes must operate with fewer than four high voltage breakdowns in an eight-hour shift and with as few missing RF pulses as possible (less than 10/Hour is desirable). Current status on these criteria is described. Efficiencies achieved with these tubes are in the 45 to 50 percent range. Approaches to improve this performance are described.

9775 **A Crossed undulator system for a variable polarization synchrotron radiation source.** Kim, K-j. (Lawrence Berkeley Lab., Berkeley, CA). pp 21-32 of Applications of circularly polarized radiation using synchrotron and ordinary sources. Allen, F.; Bustamante, C. New York, NY; Plenum Press (1985). (CONF-8405239—).

From Workshop on applicatons of circularly polarized synchrotron radiation; Albuquerque, NM, USA (18 May 1984).

A crossed undulator system can produce synchotron radiation whose polarization is abitrary and adjustable. The polarization can be linear and modulated between two mutually perpendicular directions, or it can be circular and can be modulated between right and left circular polarizations. The system works on low emittance electron storage rings and can cover a wide spectral range. Topics discussed include the basic principle of the system, the design equations and the limitations in performance.

4304 Storage Rings

REFER ALSO TO CITATION(S) 9710, 9711, 9716, 9773, 9853, 10298

9776 **(CONF-8610173—1) HISTRAP proposal: heavy ion storage ring for atomic physics.** Olsen, D.K.; Alton, G.D.; Datz, S.; Dittner, P.F.; Dowling, D.T.; Haynes, D.L.; Hudson, E.D.; Johnson, J.W.; Lee, I.Y.; Lord, R.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001820.

From 11. conference on cyclotrons and their applications; Tokyo, Japan (13 Oct 1986).

HISTRAP is a proposed synchrotron-cooling-storage ring optimized to accelerate, decelerate, and store beams of highly charged very-heavy ions at energies appropriate for advanced atomic physics research. The ring is designed to allow studies of electron-ion, photon-ion, ion-atom, and ion-ion interactions. An electron cooling system will provide ion beams with small angular divergence and energy spread for precision spectroscopic studies and also is necessary to allow the deceleration of heavy ions to low energies. HISTRAP will be injected with ions from either the existing Holifield Heavy Ion Research Facility 25-MV tandem accelerator or from a dedicated ECR source and 250 keV/nucleon RFQ linac. The ring will have a maximum bending power of 2.0 T.m and have a circumference of 46.8 m.

9777 **(INIS-SU—369, pp 250-253) Experiments on the slow extraction of electrons from the N-100 storage ring.** Bulyak, E.V.; Gladkikh, P.I.; Efimov, S.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Slow extraction 100 MeV electrons in the vertical plane using the third order resonance in two regimes is performed: with preliminary storage of a beam and quasicontinuous, at the N-100 storage ring. It is shown, that the main part of the beam is deflected by septum, the beam dimensions being 1.5 mm, which is in a good agreement with the calculation results. The extraction efficiency is 40 +- 8%.

9778 **(INIS-SU—369, pp 254-257) Status on experiments with an optical klystron in the IYaF SO AN SSSR.** Vinokurov, N.A.; Voblyj, P.D.; Kornyukhin, G.A. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Results of experiments with an optical klystron (OK) at the VEPP-3 storage ring are presented. The OK comprises two multilayer dielectric mirrors with maximum of reflection at the wave length equal to 6300 A. The OK-3 magnetic system represents three separable sections: two ondulators and a buncher. The buncher is a compensated wiggler with three poles. Magnetic field is generated by six coils with series feed. The magnetic system ensures amplification factor equal to 6-8% per flight at the current of 25 mA. Beam parameters in the VEPP-3 storage ring and parameters of the OK-2 and OK-3 magnetic systems arepresented.

9779 (INIS-SU—369, pp 262-267) **Superconducting snake with the field of 75 kGs for the VEPP-2M electron-positron storage ring.** Anashin, V.V.; Vasserman, I.B.; Vlasov, A.M. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Superconducting "snake" with the field of 75 kG is established in the VEPP-2M electron-positron storage ring for increase of colliding beam luminosity up to 2 x 10^{31} cmsup(-2)sdup(-1) in the energy range from 2 x 200 to 2 x 700 MeV. The "snake" comprises three central magnets with the field of 75 kG and two side ones with the field of 45 kG and it is placed in one of rectilinear experimental gaps. Description of design peculiarities of the "snake" and its parameters are given. Parameters of beams with switched on and switched off "snake" as well as parameters of coils and superconducting wire are presented.

9780 (INIS-SU—369, pp 343-346) **Study on the UNK superconducting magnet model transition into a normal state.** Andreev, N.I.; Antonichev, G.M.; Vasil'ev, L.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Energy accumulated in the UNK superconducting dipole (SCD) exceeds 1 MJ. To protect SCD and to dissipate energy a system is used, in which a section of SCD ring compising several magnets is artificially transfered into the normal state, when atransition in one of the magnets is registered. This section isshunted while the rest part of the ring is controlled in the superconducting state. Special heaters placed in each magnet should necessarily cause rapid transition of largest possible part of superconducting coil to the normal state for effective operation of the system. A short model with internal heaters is developed to study SCD forced transitions in IHEPh. Results of investigation of the model are given. Estimation of transient load for full-scale SCD with similar heaters was carried out based on the results obtained. The estimation revealed that that it did not exceed 10 x 10^6 A^2s, that can result in increase of maximum temperature of winding under real conditions up to 200 K.

9781 (INIS-SU—369, pp 347-349) **Development and investigation of a superconducting quadrupole magnet model.** Andreev, N.I.; Balbekov, V.I.; Bulatov, Eh.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Parameters and estimated performance of the UNK superconducting quadrupole magnet are given. Test of the model was carried out in submerged cryostat with developed-boiling helium. Investigations of magnet operation in pulsed regime disclosed that it can operate for a long period of time at triangular and trapezoidal cycles. Maximum strength of the magnetic field is 4.96 T and maxmum operating current is 5.860 kA. Values of direct and indirect nonlinearities are given.

9782 (INIS-SU—369, pp 368-370) **Radiation protection of a superconducting ring on the proton loss localization in the UNK.** Drozhdin, A.I.; Maslov, M.A.; Mokhov, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Results of calculation of radiation protection system of superconducting magnetic structure (SMS) of the UNK second stage are given. Density distribution of proton losses in SMS atlocalization in two planes by 1% from total beam intensity of 400 GeV protons is given. Results of calculation of loss distribution after introduction of the collimator system are presented. It is shown that the level of linear density of particle losses doesn't exceed approximately 10^7 prot./m; the developed measures for SMS protection permit to ensure magnet and lens operability at localization at the initial moment of the UNK working cycle several per cent of designed intensity.

9783 (INIS-SU—369, pp 392-394) **UNK first stage magnetic field correction system.** Balbekov, V.I.; Volkov, I.B.; Gurov, G.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

Description and performances of the UNK first stage magnetic field correction system are given. The correction system is intended to carry out the following functions: the closed orbit correction; betatron frequency correction; chromaticity correction and the resonance harmonic excitation under slow extraction; betatron oscillation linear coupling correction, magnetic field cubic nonlinearity correction. Prototypes of dipole and sextapole correctors are constructed and tested. A prototype of a unified power supply based on the constant voltage pulse-duration transistor converter is constructed and tested.

9784 (INIS-SU—369, pp 238-245) **BEhP electron-positron storage ring-cooler.** Anashin, V.V.; Vasserman, I.B.; Veshcherevich, V.G. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

The 700 MeV BEhP electron-positron storage ring-cooler under construction, which designed as a booster for the VEPP-2M is described. The maximum injection energy of beams in the VEPP-2M will increase from 550 to 700 MeV which permits to attain the luminosity of $7x10^{31}$ cmsup(-2) ssup(-1). The BEhP magnetic system consists of 12 lattices, each of them being a FODO-cell. The BEhP ring will replace the VEPP-2 storage ring. The basic parameters of beams and magnetic system are presented. Presently all the BEhP units are being manufactured and itsmounting has already been started.

9785 (KEK—84-14, pp 23-42) **HERA.** Wiik, B.H. (Hamburg Univ., Germany, F.R. 2. Inst. fuer Experimentalphysik). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

HERA is an electron-proton colliding beam facility under construction at DESY in Hamburg. It is designed to collide 820 GeV protons with 30 GeV electrons in four interaction regions. Its construction started in May, 1984. The layout of HERA is shown. Four 360 m long straight sections are joined by four arcs with a radius of 779.2 m yielding a total circumference of 6336 m. The tunnel containing the two rings is located some 10 - 30 m below the surface, and intersects the PETRA ring at a depth of 20 m, and only short injection paths are needed to connect the two accelerators. The general design parameters and the superconducting magnet parameters are summarized in tables. Some of the most important milestones for the HERA project are also listed in a table.

9786 (KEK—84-14, pp 86-94) **TRISTAN at KEK, Japan.** Ozaki, Satoshi. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

The construction of TRISTAN began in the fall of 1981. The present plan aims at obtaining e^+e^- collisions at about 60 GeV in the total energy. With superconducting RF cavities, on which an extensive development work is in progress, the maximum total energy can be substantially increased. The design goal for the luminosity is 1 x 10^{31} $cm^{-2}sec^{-1}$ at 60 GeV. The optimal design luminosity peaks at 27 GeV with a value of 7 x 10^{31} $cm^{-2}sec^{-1}$ and fall off to 2 x 10^{31} $cm^{-2}sec^{-1}$. The construction of the Main Ring is in progress almost on schedule with target date of the first collision in the fall of 1986. The Accumulation Ring has been in operation since November 1983.

9787 (KEK—84-14, pp 43-67) **LEP the large electron-positron project.** Schopper, H. (European Organization for Nuclear Research, Geneva, Switzerland). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

LEP is an e^+e^- ring optimized for about 100 GeV per beam. The ring has a circumference of about 26.7 kilometers, and will be 80 to 125 meters deep underground. The existing accelerators, both the PS and the SPS, will be used as injectors. The cost of LEP is 910 million Swiss francs, at 1981 prices. This document describes the outline of the LEP project, especially, in relation to the present CERN site and experimental facilities. The present status of LEP, that is, machine ordering, installation or modification of the existing machines, is explained in the following areas: injection system, magnets, accelerating system, and experimental areas. As for the civil engineering works two international consortia are responsible for the excavation of the tunnel for the main ring. Some photographs are presented to show the status of the civil engineering works. For the transportation of both components and people, a monorail suspended from the ceiling of the tunnel is adopted. The first injection test into an octant is planned in the autumn of 1987, and the first beam all around the LEP will be at the end of 1988.

9788 (KEK—84-14, pp 207-225) **Large hadron collider in the LEP tunnel. A feasibility study of possible options.** Brianti, G. (European Organization for Nuclear Research, Geneva, Switzerland). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

A wide range of possibility exists for a hadron collider in the LEP tunnel. From the machine point of view, the high luminosity operation is indeed feasible with the pp option. The basic machine structure can be used for other possibility, for instance, for the collision of the electrons of LEP with the protons of the hadron collider up to a center of mass energy of about 2 TeV. The collision of ions would also be possible. A proton-proton collider can be installed in the tunnel above LEP. A center of mass energy of about 18 TeV could be reached with the superconducting magnets of 10 T. The layout, parameters and performance of the p-p collider are described. According to present knowledge, magnets with smaller field, say 6 or 7 T (center of mass energy between 10 and 13 TeV) could be built after a shorter programme of technological development. All other machine components and systems appear to be feasible with the present technology.

9789 (KEK—85-6, pp 260-302) **B/UPSILON factory at KEK.** Aihara, Hiroaki. (Tokyo Univ., Japan). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

The B/UPSILON factory is proposed as a post-TRISTAN project at KEK. It is a high luminosity e^+e^- colliding beam machine to produce UPSILON family and B mesons. Physics motivations and luminosity requirement of the machine are discussed. Some remarks on detectors at the factory are also made.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 9085, 9134, 9755, 9756, 9757, 9758, 9759, 9760, 9761, 9926, 10142, 10211, 10288, 10299, 10425

9790 (AD-A—172290/9/XAB) **Preliminary evaluation of US Army radiac detector DT-236/PD and radiac computer-indicator CP-696/UD. Technical report.** Zeman, G.H.; Dooley, M.; Mohaupt, T.M. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Jul 1986. 15p. (AFRRI-TR—86-2). NTIS, PC A02/MF A01.

Performance of the DT-236/PD and CP-696/UD dosimetry system was studied in preliminary tests at AFRRI in cobalt-60 and in TRIGA-reactor radiation fields. The test results are relevant to the reproducibility of the dosimeter reader, the variability of readings among identically irradiated of dosimeter response in the AFFRI radiation fields. The performance specifications for this system list + or - 40% accuracy at doses of 50-1000 rads and + or - 20-rad accuracy at 0-50 rads. The present tests showed the system to be capable of meeting these specifications and, with care, a level of accuracy of + or - 10% to 20% was achieved at high doses. At low doses, the accuracy of the system was limited by the + or - 20-rad (2 SD) variability in readings of nonirradiated dosimeters. Factors found to improve the precision of dosimeter readings were (a) warm-up time of several hours for the reader unit, (b) sustained firm pressure on the mechanical switch that initiates the read cycle, (c) triplicate readings sustained firm pressure on the mechanical switch that initiates the read cycle, (d) triplicate readings of each dosimeter, (e) digital readout of the dose values, (f) proper accounting of dosimer predose readings, and (g) waiting 2 hours after irradiation before reading the dosimeter.

9791 (CEA-R—5348) **Standardisation of gas containers used in γ spectrometry.** Pineira, T.; Goenvec, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Protection contre les Rayonnements). May 1986. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750768.

The diversity of gamma spectrometry applications brings out the need to standardise the conditioning of samples (gas-liquid, etc ....). Such standardisation leads to better suited and reproducible geometries but also to reduced costs and higher quality calibrations. In the case of radioactive gas analysis by γ spectrometry two containers proved necessary: - a routine low-activity geometry for samples only slightly radioactive but numerous enough to warrant the use of automatic sample conveyors (SG 500 G); - an exceptional low-activity geometry for special analyses where the best detection limit is required (SG 3000 G). The design of the container is directly influenced by the manner of sampling. The vacuum inside it implies in particular the use of the stop valves of a special type (self-closing joints). Pressurization lowers the measurement threshold but most not exceed 5 bars. The material used to make the containers (AG3M) was chosen for its low alternation power to gamma radiation. The wall thickness in contact with the detector is 1 mm for SG 500 container and 1.5 mm for the 3000 cm^3 geometry. The measurement lines can be calibrated with a mixture of three standard gaseous radionucleides (^{133}Xe, ^{85}Kr and ^{127}Xe).

9792 (CEA-R—5356) **Correction of the counting losses in a photon spectrum owing to gamma-gamma, gamma-X and X-X coincidence summing.** Lepy, M.C.; Morel, J.; Chauvenet, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Office des Rayonnements Ionisants). May 1986. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750769.

Coincidence summing between gamma and X-rays disturbs photon spectra. So, a program making the corrections of the counting losses owing to this effect was realized. Any decay scheme (β^-, β^+ electron capture) can be treated. First developed for pin-point sources, the calculation was extended to disc shaped and cylindrical sources, by computing the efficiency for any point from a reference position.

9793 (CERN-EP—86-137) **On the optical readout of gas avalanche chambers and its applications.** Suzuki, M.; Breskin, A.; Charpak, G.; Daubie, E.; Dominik, W.; Fabre, J.P.; Gaudean, J.; Sauli, F.; Sauvage, D.; Strock, P.; Zeludziewicz, T. (European Organization for Nuclear Research, Geneva (Switzerland); Weizmann Inst. of Science, Rehovoth (Israel); Mons Univ. (Belgium); Warsaw Univ. (Poland)). 25 Sep 1986. 15p. (CONF-8606240—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900141.

From 3. Pisa meeting on advanced detectors; Pescaia, Italy (2 Jun 1986).

Gaseous avalanche counters with mixtures containing the vapour of triethylamine, are coupled to an optical readout system. Different configurations are studied in order to visualize ionization tracks produced by high-energy particles or images caused by vacuum ultraviolet light. This instrument has potential applications in the study of rare or complex events - such as the search for double-beta and proton decay - or in Cherenkov ring imaging.

9794 (DOE/ER/40096—T1) **Study of transfer reactions and inelastic scattering to giant multipole resonances using a 4π scintillator array (the Plastic Box): Final report.** Van Bibber, K.; Yearian, M.R. (Stanford Univ., CA (USA). High-Energy Physics Lab.). 1986. Contract AT03-83ER40096. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003161.

Two separate research activities are described. The initial testing results for the Plastic Box detector and its application to the study of transfer and breakup processes in heavy ion collisions is described. After initial studies it was concluded that the Plastic Box suffered from significant limitations, principally limited particle identification and very poor angular correlation information. Design modifications are being implemented. The second research activity investigated an anomalous branching ratio for the isoscalar giant quadrupole resonance in ^{238}U reported in inelastic scattering of both electrons and alpha particles. 5 refs., 7 figs.

9795 (INIS-BR—556) **Radioactive concrete sources for calibration of uranium exploration and environmental field instruments constructed at IRD/CNEN, Brazil.** Barreto, P.M.C.; Austerlitz, C.; Malheiros, T.; Lovborg, L. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil); Risoe National Lab., Roskilde (Denmark)). 1986. 74p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87700473.

A radiometric calibration system constructed at the Instituto de Radioprotecao e Dosimetria (IRD) of the Brazilian Nuclear Energy Commission (CNEN) to be used by geophysicists interested in uranium exploration and scientists working with natural radioactivity and environment is described. The system consists of 8 radioactive concrete sources. The sources are of cylindrical shape with 3m diameter and 0,5m thickness weighting approximately 7.5 tonnes. Uranium, thorium and potassium ores were added to the concrete under conditions to achieve perfect homogenization. One hundred four samples were collected and analysed by eight laboratories. In addition, in-situ radiometric grade determination were performed with calibrated instruments. U, Th and K reference values were then assigned to each source. The system also has a 4m diameter water pond for cosmic-ray and instrument noise corrections.

9796 (INIS-mf—10512, pp 33) **Determination of physical glow curve parameters of TLD-600 after alpha- and neutron irradiation.** Vana, N.; Motallebi, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9797 (INIS-mf—10512, pp 86) **Improvement programm for the calorimeter in the UA-1 experiment.** Krammer, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9798 (INIS-mf—10518) **Energy spectrometers.** Hajek, B. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). Sep 1985. 56p. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700290.

Normalizace v jaderne technice. No. 2.

Brief characteristics are given of various gamma spectrometers manufactured by the Tesla Research Institute for Nuclear Instruments in Premysleni. Standards recommended for these spectrometers in 1975, and CMEA standards issued between 1976 and 1984 which have been incorporated in the Czechoslovak standard are listed. The full wording is given of the Czechoslovak state standard "Spectrometers of energies of ionizing radiation - methods of measuring basic parameters" and the Tesla Premysleni enterprise standard "Instruments for nuclear technology - testing methods of physical parameters".

9799 (INIS-mf—10519, pp 30) **Spectrometric monitor of gaseous effluents from nuclear power plant.** Kapisovsky, V.; Kubik, I.; Sevecka, S. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice, Czechoslovakia). Apr 1986. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9800 (INIS-mf—10519, pp 37) **SM 4-20 computer based graphics for spectrometry.** Jancik, O.; Kapisovsky, V.; Bena, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice, Czechoslovakia). Apr 1986. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9801 (INIS-mf—10519, pp 38) **Gamma spectrometry at high counting rates.** Obrusnik, I.; Horak, Z. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9802 (INIS-mf—10519, pp 39) **Optimization of software for Nuclear Data gamma spectrometry system.** Faltejsek, J.; Horak, Z.; Kucera, J.; Obrusnik, I. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9803 (INIS-mf—10519, pp 40) **Determination of correction for actual summations in spectrometric measurements using Monte Carlo method.** Dryak, P.; Kovar, P.; Kokta, L. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9804 (INIS-mf—10519, pp 41) **Description of physical properties by Laurent series obtained with linear least square fit.** Dryak, P. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9805 (INIS-mf—10519, pp 42) **Experience with Canberra 90 multichannel analyzer performance.** Kovar, P.; Dryak, P.; Kokta, L. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9806 (INIS-mf—10519, pp 45) **SAPI-1 microcomputer operating as multichannel pulse analyzer.** Spacek, B. (Ustav Nerostnych Surovin, Kutna Hora, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9807 (INIS-mf—10519, pp 49) **Determination of radon and thoron by alpha spectrometry.** Kominek, A.; Mrnustik, J. (Vyzkumny Ustav Stavebnich Hmot, Brno, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9808 (INIS-mf—10519, pp 34-35) **Calculating the efficiency of a semiconductor gamma detector in monitoring the activity of a medium flowing through a cylindrical pipe.** Bouda, T. (Vyvojovy Zavod Uranoveho Prumyslu, Straz pod Ralskem, Czechoslovakia. Vyzkumny a Vyvojovy Ustav). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9809 (INIS-mf—10519, pp 36) **Performance testing of planar semiconductor detectors.** Benada, J.; Spacek, J. (Ustav Nerostnych Surovin, Kutna Hora, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9810 (INIS-mf—10519, pp 43) **Assessment of Ge(Li) detector scanning by comparison with Monte Carlo calculation.** Hnatowicz, V.; Kozarova, P. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky; Karlova Univ., Prague, Czechoslovakia. Fakulta Matematicko-Fyzikalni). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9811 (INIS-mf—10519, pp 50) **Determination of natural radioactivity of building materials.** Mrnustik, J.; Kominek, A. (Vyzkumny Ustav Stavebnich Hmot, Brno, Czechoslovakia). Apr 1986. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9812 (IPNO-T—84-07) **Study of a large solid angle $\pi0$ detector for the test experiment of symmetry charge $dd \rightarrow \alpha\pi^0$.** Pignault, G. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1984. 248p. (In French). NTIS (US Sales Only), PC A11/MF A01. File Number DE87750750.

This thesis presents the study of a large solid angle π^0 detector, designed primarily for a charge-symmetry testing experiment ($dd \rightarrow \alpha\pi^0$). It is a cylindrical multishell Cerenkov counter. In a first part, we review the experimental and theoretical situation of the studies about charge symmetry; past and experiments are listed, in connection with their theoretical interpretation. In a second part, we present first the principle and general design of the detector; after that, we reckon the performances of the various versions that are considered using computer-simulations. The results of tests with an electron beam is then compared with the simulations in order to assess their reliability. Finally, the arguments favouring the final choice are explained and some future experiments described.

9813 (JAERI-M—85-004) **Development of aerial gamma radiation survey system 4. Simulative calculation of field experiments and accumulation of fundamental data on environmental gamma ray characteristics.** Saito, Kimiaki; Nagaoka, Toshi; Sakamoto, Ryuichi; Tsutsumi, Masahiro; Moriuchi, Shigeru. (Japan Atomic Energy Research Inst., Tokyo; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1985. 53p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700288.

Field experiments have been performed by JAERI since 1982 to obtain fundamental data required for development of aerial radiation survey system. In order to supplement the fundamental radiation data, theoretical calculations have been carried out. The utilized Monte Carlo transport program was verified by simulative calculations of the field experiments, and characteristics data on environmental gamma rays have been accumulated. In this report, the field experiments in 1981 and 1982 were simulated making use of the Monte Carlo transport calculation code YURI developed in JAERI. Comparisons were made between experimental and calculated results for exposure rate and flux density originated from terrestrial sources, and from a point source at height of 2.5 m above the ground. Good agreements between the data verified the transport program. As fundamental characteristics data on environmental gamma rays, spatial distributions of exposure, fluence, energy spectra, angular spectra and average energy were reported and discussed, for terrestrial sources of ^{40}K, ^{232}Th-series and ^{238}U-series, for a plane source on the ground and for a point source at 2.5 m above the ground.

9814 (Juel-Spez—316, pp 75-77) **General lattice dynamics programme for the optimization of experiments at the triple-axis spectrometer UNIDAS.** Eckold, G.; Hahn, T.; Weber, H.J. (Technische Hochschule Aachen, Germany, F.R. Lehrstuhl und Inst. fuer Kristallographie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9815 (Juel-Spez—316, pp 167-170) **Four-circle diffractometer P110 at the Orphee reactor, C.E.N. Saclay.** Reimers, W.; Guth, H.; Schweiss, P.; Hellner, E.; Massing, S.; Heger, G. (Marburg Univ., Germany, F.R. Inst. fuer Mineralogie, Petrologie und Kristallographie; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Nukleare Festkoerperphysik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9816 (Juel-Spez—316, pp 171-175) **Powder diffractometer in Juelich with spatially resolving scintillation-detector.** Schaefer, W.; Jansen, E.; Will, G. (Bonn Univ., Germany, F.R. Mineralogisch-Petrologisches Inst. und Museum; Bonn Univ., Juelich, Germany, F.R. Aussenstelle fuer Neutronenbeugungsforschung). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The neutron powder diffractometer at the FRJ-2 in Juelich has got a spatially resolving measuring technique. The construction of the detector is based on a modified Anger technology. (BHO).

9817 (Juel-Spez—316, pp 176-181) **Neutron measurements with a flat-cone diffractometer.** Hohlwein, D.; Hoser, A.; Prandl, W. (Tuebingen Univ., Germany, F.R. Inst. fuer Kristallographie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The present lecture has three parts: in the first equipment and flatcone geometry are discussed, then the measurement and evaluation of a complete data record of Bragg reflections are reported; the last part deals with the measurement of the elastic diffuse scattering in ND_4Cl, where information on the orientation short-range order is obtained. (BHO).

9818 (Juel-Spez—316, pp 209-210) **Neutron diffractometer SV 28 at the FRJ2-DIDO in Juelich.** Bartl, H.; Pfeiffer, F.; Link, K.H.; Weitzel, H. (Frankfurt Univ., Germany, F.R. Inst. fuer Kristallographie und Mineralogie; Technische Hochschule Darmstadt, Germany, F.R. Inst. fuer Physikalische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9819 (Juel-Spez—316, pp 211-213) **New low temperature hole-circle Eulerwiege.** Elf, F.; Will, G.; Dujka, B.; Chatzipetros, J. (Bonn Univ., Germany, F.R. Mineralogisch-Petrologisches Inst. und Museum; Bonn Univ., Juelich, Germany, F.R. Aussenstelle fuer Neutronenbeugungsforschung; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Technische Dienste). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9820 (Juel-Spez—316, pp 214-216) **Pseudostatistic time-of-flight spectroscopy.** Freudenberg, U.; Bongratz, R. (Technische Univ. Muenchen, Germany, F.R. Fakultaet fuer Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9821 (Juel-Spez—316, pp 217-222) **'FOTOF'-proposal for a new highly resolving spectrometer.** Gaehler, R.; Golub, R. (Technische Univ. Muenchen, Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

A neutron spectrometer is proposed the basis concept of which has similarities with the spin-echo idea (NSE). It is suitable for quasielastic scattering for energy transfers in the medium neV-range. (BHO).

9822 (Juel-Spez—316, pp 223-225) **Backscattering diffractometer at FRM.** Faisst, T.; Stierstadt, K. (Muenchen Univ., Germany, F.R.). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

9823 (KEK—84-14, pp 152-186) **On detector related machine and instrumentation issues.** Ekeloef, T. (Uppsala Univ., Sweden). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

This is a summary report of the panel discussions on detector related machine and instrumentation issues. Each of the panel members presented an introductory presentation of the following topics. Those are the three most revealing future experiments, calorimetry for jets and total energy, tracking and momentum, identification of e, μ and other particles, trigger and data acquisition and building large detectors in cooperation with industry. In the discussion on the detectors at future large hadron colliders, much emphasis was given to calorimetric measurement, muon measurement, and microvertex detection. There is a need for inexpensive and radiation-hardened front-end electronics for all detectors. As to data acquisition and analysis, the use of a sequence of successive trigger levels with a large number of emulators (of the order of 100) in the last stage and the use of optical discs for data storage would be needed at the highest luminosity. It is clear that the development of the instrumentation technique mentioned constitutes a prerequisite for the efficient use of future large hadron colliders. When considering the detectors for future large positron-electron colliders, some of the technical problems mentioned were drastically simplified, in particular those related to the high collision rate like signal pile-up, radiation damage and fast data processing.

9824 (KEK—84-14, pp 291-309) **International cooperation in detector research and development.** Fabjan, C.W. (European Organization for Nuclear Research, Geneva, Switzerland). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

The international collaboration dealing with the research and development (R and D) of detectors for TeV region physics is reported. In this report, it is attempted to analyze which and in what form interregional R and D on detectors may be suitable for the experiment at a hadron machine. Calorimetry was used as an example to illustrate the range of development required. An important and successful aspect of interregional collaboration concerns the definition of standard in the field of data acquisition. The reconstruction of the complete system is required, and this implies the measurement of all particles. This can be done only with calorimetric techniques. The methodical and technological development of calorimetry is presented. The role of the tracking and momentum analysis will require reassessment. Tracking will be essential for several auxiliary measurement. For the R and D, the collaboration between different groups has been made. For example, the ring-imaging Cherenkov tests, the uranium calorimeter tests and the test of a uranium-liquid argon hadron calorimeter were made by the collaboration of several groups. The collaboration with industry has been also made.

9825 (KEK—85-4, pp 183-193) **Monopole search with SQUID fluxmeters and with metastable superconducting granules.** Ebisu, Takeo; Watanabe, Tadashi. (Kobe Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

First, our experiments of monopole search in ferromagnetic materials are recapitulated which have been performed with SQUID fluxmeters KOBE I and II in our laboratory. An upper limit of monopole density in old iron ore and that of flux in cosmic ray are given as 3.2 x 10^{-6} monopoles/gram (95% C.L.) and 5.9 x 10^{-10} $cm^{-2}sec^{-1}str^{-1}$ (90% C.L.), respectively. Second, a report is made on the progress of preparing our next experiment. By using a larger-scale fluxmeter KOBE III with two sensing parts, each containing a two-turn, 20-cm-diam search coil, we intend to search for magnetic monopoles in this summer in large under a conveyer of sintering furnace at a commercial ore processing plant. Last, we will briefly discuss on a feasible detector based on the flipping mechanism of metastable superconducting granules. It is one of the most favorable as a large-area monopole detector, since the signal in magnetic flux change not only is expected in β-independent way but also may be read by conventional electronics and expensive SQUID systems are not needed.

9826 (KEK—85-5, pp 371-386) **DO detector.** Yamada, Ryuji. (Fermi National Accelerator Lab., Batavia, IL, USA). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Hadron collider physics turned out very fruitful as shown in the recent results given by UA1 and UA2 groups. The Fermilab Tevatron project already has the CDF detector in its construction stage. The construction of a second major collider detector, the DO detector, was approved in 1984, and will be complimentary to the CDF detector. The DO detector is superior in its many design features compared with the other existing hadron collider detectors, including highly segmented calorimeters as well as better energy resolution for hadrons and leptons. In this respect, design requirements for the DO detector are listed and its general features are outlined citing the general overall detector parameters and performance specifications. The central detectors consist of the central section and the large angle section. The former is made up of a vertex detector, layers of transition radiation detectors and layers of drift chambers. For calorimetry, there are a central calorimeter, two end-cap calorimeters and two plug calorimeters. The reasons for the choice of the liquid argon calorimeter are described along with the reasons why the depleted uranium was chosen as the absorber. The muon detection system, trigger and data acquisition are also outlined.

9827 (KEK—85-6, pp 168-209) **4π detector at multi-TeV hadron collider.** Watanabe, Y. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

What experiments would be like at a multi-TeV hadron collider and the feasibility of a general-purpose detector to uncover new phenomena in such a high energy machine are described. Although much R and D is needed in almost every part, a 4π detector can be built and operated at the maximum luminosity of up to 10^{33} $cm^{-2}s^{-1}$. But the detector must be necessarily big and costly. The typical size is about $(20\ m)^3$, the weight is about 20 ktons, the number of channels is about 1/2 million, and the cost is about 250 M$. The construction will take as many years as that of the machine itself. An intense program of R and D on every aspect must be vigorously pursued.

9828 (KFKI—1986-14/K) **Implementation, calibration, data processing and testing of a portable solid-state gamma spectrometer for in-situ dose rate determination.** Nemeth, I.; Zombori, P.; Urban, J.; Andrasi, A.; German, E.; Kemenes, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Paksi Atomeroemue Vallalat (Hungary)). Apr 1986. 44p. (In Hungarian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700289.

The in-situ determination of the environmental dose rate by portable semiconductor gamma spectrometer is discussed. The high purity Ge-detector available for in-situ measurements was calibrated. The energy and direction dependence of the sensitivity of the detector was taken into account. A computer code was developed for data transfer for automatic evaluation of the environmental spectra. The measurements were performed in the vicinity of the Paks Nuclear Power Plant with the participation in international intercomparision. The results were compared to the data of previous measurements. 9 refs.

9829 (KFTI—84-9) **Device for the polarization P parameter measuring on the Kharkov 2 Gev electron linac using magnetostriction spark chamber.** Baratashevskij, A.S.; Zybalov, A.A.; Zinov'eva, O.G.; Karasev, S.P.; Konovalov, O.G.; Skusinets, V.N.; Storozhenko, Yu.O.; Tenishev, A.Eh. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1984. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700472.

Automatic device for measuring proton polarization on the LUE-2 GeV Kharkov electron linac on the basis of telescope of magnetostriction spark chambers and magnetic spectrometerwas created. Measurings of polarization parameter in the *gD$^-$ → pn reaction at an angle of 90 deg of c.m.s.are conducted for Esub(*g)=300, 350 and 520 MeV. Data processing in the experiment was carried out by the M-6000 and ES-1022 computers, that permits to plan dynamically a statistics collection. The obtained values of polarization are in agreement with existing data in the limits of errors. The developed device provides sufficiently high rate of event collection with energy resolution (ΔEsub(*g) = +- 12.5 MeV) better, than at similar devices operating in other laboratories all over the world. 26 refs.; 6 figs.; 1 tab.

9830 (KFTI—84-20) **Simulation of a short-cable Q-meter for measuring the deuteron target polarization.** Karnaukhov, I.M.; Lukhanin, A.A.; Telegin, Yu.N.; Trotsenko, V.I.; Chechetenko, V.F. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1984. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700471.

Simulation of Q-meter with a phase automatic-frequency control of a reception circuit is carried out in the paper. Effect of circuit parameters and connecting cable on Q-meter sensitivity and magnitude of distortions of recorded signal is studied. It is shown that usage of the cable with a length of lambda/12-lambda/10 instead of traditional semiwave one enables to increase essentially the circuit sensitivity at the same distortion rate. Errors conditioned by distortions of the deuteron magnetic resonance (DMR) signal forms in the reception circuit, which can effect essertially on accuracy of deuteron polarization detection by the method of DMR spectrum decomposition, are discussed. It is shown that in the case of utilization of a short cable the polarization error due to spectrum distortions does not exceed 4...5%. 4 refs.; 7 figs.; 5 tabs.

9831 (KURRI-TR—268, pp 33-36) **Development of position sensitive detector.** Nagayama, K. (Osaka Univ., Ibaraki, Japan. Research Center for Nuclear Physics). 1985. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780040. (CONF-8408209—).

From Development of advanced technology for scientific research conference; Kumatori, Osaka, Japan (7 Aug 1984).

9832 (LBL—21931) Pressure regulation system for modern gas-filled detectors. McDonald, R.J. (Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003635.

A gas pressure and flow regulation system has been designed and constructed to service a wide variety of gas-filled detectors which operate at pressures of ~2 to 1000 Torr and flow rate of ~5 to 200 standard cubic centimeters per minute (sccm). Pressure regulation is done at the detector input by a pressure transducer linked to a solenoid leak valve via an electronic control system. Gas flow is controlled via a mechanical leak valve at the detector output. Interchangeable transducers, flowmeters, and leak valves allow for different pressure and flow ranges. The differential pressure transducer and control system provide automatic let-up of vacuum chambers to atmospheric pressure while maintaining a controlled overpressure in the detector. The gas system is constructed on a standard 19" rack-mounted panel from commercially available parts. Five of these systems have been built and are routinely used for both ionization chambers and position-sensitive avalanche detectors.

9833 (MPI-PAE/Exp.El.—164) New detector concepts. Kemmer, J.; Lutz, G. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Messerschmitt-Boelkow-Blohm G.m.b.H., Muenchen (Germany, F.R.)). Jul 1986. 39p. (CONF-8603109—6). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750316.

From 4. European symposium on semiconductor detectors; Munich, F.R. Germany (3 Mar 1986).

On the basis of the semiconductor drift chamber many new detectors are proposed, which enable the determination of energy, energy loss, position and penetration depth of radiation. A novel integrated transistor-detector configuration allows non destructive repeated readout and amplification of the signal. The concept may be used for the construction of one or two-dimensional PIXEL arrays.

9834 (N—86-32910) Portable spectrometer for use from 5 to 15 micrometers. Hoover, G.; Kahle, A.B. (Jet Propulsion Lab., Pasadena, CA (USA)). Jul 1986. 56p. (NASA-CR—179751; JPL-PUB—86-19; NAS—1.26:179751). NTIS HC A04/MF A01.

A field portable spectrometer suitable for collecting data relevant to remote sensing applications in the 8 to 12 micrometer atmospheric window has been built at the Jet Propulsion Laboratory. The instrument employs a single cooled HgCdTe detector and a continuously variable filter wheel analyzer. The spectral range covered is 5 to 14.5 micrometers and the resolution is approximately 1.5 percent of the wavelength. A description of the hardware is followed by a discussion of the analysis of the spectral data leading to finished emissivity and radiance spectra. A section is devoted to the evaluation of the instrument performance with respect to spectral resolution, radiometric precision, and accuracy. Several examples of spectra acquired in the field are included.

9835 (N—86-33129) Joint NASA/Goddard-University of Maryland research program in charged particle and high energy photon detector technology. Progress report, October 1982-August 1986. (Maryland Univ., College Park (USA)). Oct 1986. 29p. (NASA-CR—177062; NAS—1.26:177062). NTIS HC A03/MF A01.

Progress made in the following areas is discussed: low energy ion and electron experiments; instrument design for current experiments; magnetospheric measurement of particles; ion measurement in the earth plasma sheet; abundance measurement; x-ray data acquisition; high energy physics; extragalactic astronomy; compact object astrophysics; planetology; and high energy photon detector technology.

9836 (PCCF-T—85-05) Contribution to study and realization of plastic scintillator wall associated to Diogene detector. Valero, J.J. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire). May 1985. 171p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE87750747.

In order to cover the forward solid angle of Diogene detector (up to 8°) for which this one is blind, we have realized a plastic wall equipped with scintillators. After a Monte-Carlo simulation and various tests carried out with cosmic rays, an optimum shape for the counters has been determined: NEIIO states (thickness: 20 mm) connected with parallel faces bent light guides. This shape allows 8 cm in spatial resolution. The association of the plastic wall at the central trigger in Diogene gives a better selection for central collisions.

9837 (PCCF-T—85-06) Multi-hit time converters for drift chambers. Crouau, M. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire; Clermont-Ferrand-2 Univ., 63 - Aubiere (France)). 1985. 105p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750744.

In an experiment of inverse pion electroproduction, we have been led to realize multi-hit drift time digitizers to detect the electron-positon pair. The system is based on a stable clock, and the accuracy is enhanced by phase interpolation. The time -to digital converters-near the drift chambers- are read by a dedicated CAMAC controller, and the data are dumped via a flat cable into an interface module located in a crate on the data acquisition branch, solving the problem of the distance between the detectors and the acquisition electronic.

9838 (PCCF-T—85-07) Contribution to electronics by microprocessors of an experiment realized on a very high energy accelerator. Chadelas, R. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire; Clermont-Ferrand-2 Univ., 63 - Aubiere (France)). 1985. 157p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE87750748.

We describe a fast triggering system (100 ns) which, from a wire chamber and from a hodoscope of scintillators, enables one to select events satisfying certain conditions of multiplicity and momentum threshold. By using the method of a "mask", which makes the comparison between the real events and an adjustable reference matrix possible, the kept events are those which correspond to the foreseen topology. (18 refs).

9839 (PNL-SA—14411) Instrumentation research and development in DOE health physics programs. Selby, J.M.; Vallario, E.J.; Swinth, K.L. (Pacific Northwest Lab., Richland, WA (USA); USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Nuclear Safety). Oct 1986. Contract AC06-76RL01830. 7p. (CONF-861007—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003301.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

Planning and control of exposure to ionizing radiation require the use of accurate, reliable instrumentation to establish dose rates, indicate high exposure rate areas, and control the spread of contamination. The Radiological Controls Division of US Department of Energy (DOE) operates several programs under the technical direction of DOE's lead laboratory in health physics, the Pacific Northwest Laboratory. These programs involve the evaluation and development of instruments to measure dose rates, internal depositions, and airborne and surface contamination. Several important developments, including the total dose meter, the laser-heated dosimeter reader, and a beta survey meter will be described. 17 refs., 5 figs., 1 tab.

9840 (PPA-BEN—3, pp 150-158) Use of the plastic track detector LR-115 as a fast neutron flux monitor. Bradley, D.A.; Ahmad Saat; Chong Chon Sing; Ananda Mohan Ghose. (Science Univ. of Malaysia, Minden, Pulau Pinang. School of Physics). 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

Use of the plastic track detector LR-115 type 11 as an integrating fast neutron flux monitor is discussed. It is demonstrated that good linearity of response may be obtained over a wide range of flux. A calculated registration efficiency of 3.3 x 10^{-5} tracks per neutron is shown to provide useful track densities. Using an aluminium foil sample for activation analysis it is demonstrated that its weight may be obtained to within +- 5%

9841 **(SLAC-PUB—4064) Recent progress in Cerenkov ring imaging for the SLD experiment.** Ashford, V.; Bienz, T.; Bird, F.; Gaillard, M.; Hallewell, G.; Leith, D.; McShurley, D.; Nuttall, A.; Oxoby, G.; Ratcliff, B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA); California Univ., Santa Barbara (USA). Dept. of Physics; California Univ., Santa Cruz (USA). Inst. for Particle Physics; Cincinnati Univ., OH (USA). Dept. of Physics). Aug 1986. Contract AC03-76SF00515. 7p. (CONF-860701—62). NTIS, PC A02. File Number DE87003276.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

Results of recent beam tests of a physics prototype Cerenkov Ring Imaging Detector (CRID) for the SLD experiment at the SLAC Linear Collider (SLC) are presented. The system includes both liquid (C_6F_{14}) and gas (isobutane) radiators and an 80 cm long Time Projection Chamber (TPC) with a gaseous TMAE (Tetrakis-Dimethylamino-Ethylene) photocathode and charge division readout of proportional wires. Handling of TMAE and development of a gas delivery system are discussed. Design considerations for the construction of the TPC anode planes are presented. Measurements of the multiplicity of detected Cerenkov photons, of Cerenkov angles, and the resolution with both radiators are presented. The particle identification capability of this detector is discussed.

9842 **(SLAC-PUB—4095) The analog processing system for the Liquid Argon Calorimeter for SLD at SLAC.** Haller, G.M.; Nelson, D.; Freytag, D.R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1986. Contract AC03-76SF00515. 6p. (CONF-861007—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003271.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

The analog processing system for the Liquid Argon Calorimeter for the SLD project at SLAC is described. Amplification, storage of the analog information, and multiplexing is realized on specially developed hybrids, which will be mounted directly on the detector. This leads to a substantial reduction of the cable plant. Test results for the amplifier and for the sampling and multiplexing hybrid (CDU hybrid) are presented. The latter hybrid contains a custom monolithic device, the Calorimeter Data Unit (CDU).

9843 **(SLAC-PUB—4105) Analog data transmission via fiber optics.** Cisneros, E.L.; Burgueno, G.F. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 4p. (CONF-861007—12). NTIS, PC A02. File Number DE87003277.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

In the SLAC Linear Collider Detector (SLD), as in most high-energy particle detectors, the electromagnetic noise environment is the limiting factor in electronic readout performance. Front-end electronics are particulary susceptible to electromagnetic interference (EMI), and great care has been taken to minimize its effects. The transfer of preprocessed analog signals from the detector environs, to the remote digital processing electronics, by conventional means (via metal conductors), may ultimately limit the performance of the system. Because it is highly impervious to EMI and ground loops, a fiber-optic medium has been chosen for the transmission of these signals. This paper describes several fiber-optic transmission schemes which satisfy the requirements of the SLD analog data transmission.

9844 **(SLAC-PUB—4107) The Digital Correction Unit: A data correction/compaction chip.** MacKenzie, S.; Nielsen, B.; Paffrath, L.; Russell, J.; Sherden, D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 3p. (CONF-861007—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003261.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

The Digital Correction Unit (DCU) is a semi-custom CMOS integrated circuit which corrects and compacts data for the SLD experiment. It performs a piece-wise linear correction to data, and implements two separate compaction algorithms. This paper describes the basic functionality of the DCU and its correction and compaction algorithms.

9845 **(SLAC-PUB—4108) The data acquisition system for SLD.** Sherden, D.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 9p. (CONF-861007—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003260.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

This paper describes the data acquisition system planned for the SLD detector, which is being constructed for use with the SLAC Linear Collider (SLC). Analog electronics, heavily incorporating hybrid and custom VLSI circuitry, is mounted on the detector itself. Extensive use is made of multiplexing through optical fibers to a FASTBUS readout system. The low repetition rate of the SLC allows a relatively simple software-based trigger. Hardware and software processors within the acquisition modules are used to reduce the large volume of data per event and to calibrate the electronics. A farm of microprocessors is used for full reconstruction of a sample of events prior to transmission to the host.

9846 **(SLAC-PUB—4116) Wire aging of hydrocarbon gases with TMAE additions.** Va'vra, J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 5p. (CONF-861007—9). NTIS, PC A02. File Number DE87003263.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

We report on experimental results describing wire aging properties of the CRID/RICH detectors in the TMAE gas environment. This test used 7 μm and 33 μm diameter carbon fibers, and 20 μm diameter gold-plated tungsten wires as sense wires, and operated in gas mixtures of either CH_4 or C_2H_6 at 1 atm, together with 0.6 Torr of the photoionizing vapor TMAE (tetrakis dimethylamino ethylene), which serves as a photocathode in the CRID detectors. The wires were damaged by the ^{55}Fe x-rays. This paper is based on irradiation of 20 wires, each being a separate test. The gas purity was consistent with requirements of CRID detectors (<1 ppM of oxygen, <1 ppM of water). The test explored the aging as a function of wire diameter, wire material, gas flow, gas temperature, rate of radiation and gas type. Several chemical analyses of the deposit samples were performed (FTIR, ESCA and GC-MS techniques).

9847 **(SLAC-PUB—4130) Report of the Central Tracking Group.** Cassel, D.G.; Hanson, G.G. (Cornell Univ., Ithaca, NY (USA); Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 12p. (CONF-8606215—18). NTIS, PC A02. File Number DE87003259.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

Issues involved in building a realistic central tracking system for a general-purpose 4π detector for the SSC are addressed. Such a central tracking system must be capable of running at the full design luminosity of 10^{33} cm^{-2}s^{-1}. Momentum measurement was required in a general-purpose 4π detector. Limitations on charged particle tracking detectors at the SSC imposed by rates and radiation damage are reviewed. Cell occupancy is the dominant constraint, which led us to the conclusion that only small cells, either wires or straw tubes, are suitable for a central tracking system at the SSC. Mechanical problems involved in building a central tracking system of either wires or straw tubes were studied, and our conclusion was that it is possible to build such a large central tracking system. Of course, a great deal of research and development is required. We also considered central tracking systems made of scintillating fibers or silicon microstrips, but our conclusion was that neither is a realistic candidate given the current state of technology. We began to work on computer simulation of a realistic central tracking system. Events from interesting physics processes at the SSC will be complex and will be further complicated by hits from out-of-time bunch crossings and multiple interactions within the same bunch crossing. Detailed computer simulations are needed to demonstrate that the pattern recognition and tracking problems can be solved.

9848 **(UEF—02-85) Reconstruction of two-dimensional spectrum of $\pi 0$ mesons from the spectrum of γ quanta.** Antos, J. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky). Feb 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700291.

To be published in Nuclear Instruments and Methods.

The preprint presents the numerical solution of the integral equation linking the kinematic characteristics (energy and longitudinal momentum) of gamma radiation from π^0 meson decay with the kinematic characteristics of the meson. The method allows to use gamma spectra for the reconstruction of the π^0 spectra. The results are presented of testing the method on the model reaction $\pi p \rightarrow p \pi \pi^0$, $\pi^0 \rightarrow 2\gamma$ at 5 GeV and on data from the reaction $\pi^- p \rightarrow p \pi^+ \pi^- \pi^-$, $\pi^+ \rightarrow 2\gamma$ obtained at 5 GeV at JINR with a 1 m hydrogen bubble chamber.

9849 **(ZfK—591) Bragg-peak spectroscopy of low-energy heavy ions.** Kotte, R.; Keller, H.J.; Ortlepp, H.G.; Stary, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700189.

A small axial ionization chamber with the electric field lines parallel to the particle trajectory (Bragg ionization chamber) allowing the determination of the nuclear charge and the energy of low energetic low mass heavy ions (E/A approximately 0.8 - 2.0 MeV/amu) is presented together with an adapted shaping amplifier. Using the usual technique of pulse shaping with a long and a short time constant the energy and the Bragg peak resolutions for projectiles between ${}_2{}^4$He and ${}_{16}{}^{32}$S were determined. With commercially available low purity n-pentane purified from water and oxygene by a threefold destillation an energy resolution of $\Delta E/E = 1\%$ and a charge resolving power of $Z/\Delta Z = 47$ are attainable for 41.4 MeV ^{28}Si ions elastically scattered from ^{197}Au. No significant pulse height defect is observable for the energy determination of particles with $Z <= 17$.

9850 **Low energy antiproton-nucleus annihilation radius selection using an active silicon detector/target.** McGaughey, P.L.; DiGiacomo, N.J.; Sondheim, W.E.; Sunier, J.W.; Yariv, Y. (Los Alamos National Lab., LANL, NM, USA. Physics Div.). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **249**: No. 2/3, 361-365(10 Sep 1986).

The use of an intrinsic silicon transmission detector to experimentally select the annihilation radius of low energy antiprotons in silicon nuclei is described. Through Monte Carlo modeling of the intranuclear and evaporation cascades following the annihilation, the energy deposited in the detector is correlated to the annihilation radius in the silicon nucleus. By selecting events with sufficiently large energy deposition, annihilations occurring on average within the half nuclear density radius are distinguished.

9851 **Use of a velocity filter in α-decay studies of microsecond radioactivities.** Kim, H.J.; Toth, K.S.; Rao, M.N.; McConnell, J.W. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **249**: No. 2/3, 386-390(10 Sep 1986). Contract AC05-84OR21400.

A new method of studying microsecond radioactivities of evaporation residues produced by heavy-ion reactions is described. Forward recoiling products were separated from the beam particles by using a velocity filter and implanted into a Si(Au) detector. Their subsequent α decays were then studied with the same detector.

9852 **Calculated uncertainties of absolute γ-ray intensities and decay branching ratios derived from decay schemes.** Browne, E. (Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **249**: No. 2/3, 461-467(10 Sep 1986).

This paper presents analytical methods for calculating uncertainties of absolute γ-ray intensities and decay branching ratios derived from decay schemes. The equations have been derived with standard mathematical error-propagating techniques, using first-order approximations in Taylor series expansions of absolute γ-ray intensities.

9853 **Performance of the barrel calorimeter system of the high resolution spectrometer at PEP.** Loos, J.S.; Bender, D.; Kooijman, S.; Schlereth, J.; Wood, D.E.; Shibata, E.I.; Low, E.H.; Ng, C.R.; Ong, P.P.; Rangan, L.K. (Argonne National Lab., USA; Purdue Univ., Lafayette, IN, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **249**: No. 2/3, 185-200(10 Sep 1986). Contract W-31-109-ENG-38;AC02-76ER01428.

A review of the performance of the barrel calorimeter system of the high resolution spectrometer (HRS) is given. The system has been in operation for several years at the PEP e^+e^- storage ring. The barrel calorimeter, consisting of Pb-scintillator sandwiches and proportional wire tubes with charge-division readout, measures the energies and production angles of electromagnetic showers and also provides time-of-flight for particles produced in e^+e^- collisions.

9854 **Development of an array of cooled large area Si(Li) detectors.** Pehl, R.H.; Madden, N.W.; Walton, J.T.; Malone, D.F.; Landis, D.A.; Goulding, F.S.; Cork, C.P.; Wong, Y.K.; Strauss, M.G.; Sherman, I.S. (Lawrence Berkeley Lab., CA, USA; Argonne National Lab., IL, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **248**: No. 2/3, 519-524(1 Aug 1986). Contract AC03-76SF00098.

A system containing six cooled, 34 mm diameter by 7 mm thick, high-resolution Si(Li) detectors designed to maximize the sensitivity for counting X-rays in the 10-30 keV range to measure trace radionuclides in soil samples has been successfully fabricated. The detectors were mounted in a paddle-shaped cryostat with a single large beryllium window on each side. This configuration provides for efficient anticoincidence background suppression and effectively doubles the sensitive detector area because X-rays can impinge on the detectors from both sides. To maximize detection efficiency, the thickness of the cryostat was held to a bare minimum (25 mm); this caused severe difficulties during fabrication of the system. Cutting down the rim of the detectors reduced to an acceptable level the microphony caused by movement of the beryllium window that faces the lithium-diffused contact of the detectors. Since this system will be used for low level counting, careful testing was performed to select materials having the lowest radioactivity.

9855 **Neutral-beam species determination from nuclear reaction products.** Ruby, L.; Stearns, J.W.; Pyle, R.V. (Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **248**: No. 2/3, 501-505(1 Aug 1986). Contract AC03-76SF00098.

Recent measurements designed to measure neutral-beam species by nuclear reaction analysis are reported. The detection system and several experiments intended to improve resolution and reduce noise are described. Results obtained at the LBL neutral-beam engineering test facility are discussed and compared with the predictions of optical Doppler-shift spectroscopy.

9056 A quantitative passive technique for assay of near-surface tritium in materials. Pregenzer, A.L.; Kerst, R.A. (1231, Sandia National Labs., Albuquerque, NM 87185). pp 249-252 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The electrons emitted when tritium β decays can be used to determine the amount of near-surface tritium in materials. A tritium contaminated sample is placed near a channel electron multiplier (CEM) in a vacuum chamber. If information is available about the depth distribution of tritium in the material, energy analysis of the electrons emerging from the surface allows and absolutely calibrated, noninvasive assay of the amount of tritium near this surface. The assay apparatus is described, and the method for relating the CEM counting rate of a given sample to its tritium content is explained. Comparisons with experiment are presented.

9057 A novel neutron detector for measuring the output of pulsed sources. Rowland, M.S.; Robertson, J.C. (Univ. of New Mexico, Albuquerque, NM 87131). pp 1363-1366 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A beryllium based detector has been developed which can be used to measure the output of pulsed neutron sources in the D,D and D,T fusion energy regions. The principle of this detector, and its construction, are discussed. The use of the detector in measuring the output from Kaman pulsed neutron sources and from the SPR III reactor at the Sandia National Lab. is discussed. The method used to calibrate the detector is described and theoretical calculations are presented of the variation of its efficiency with energy. The calculations were made using the MCNP and Tiger codes. Some incidental nuclear data measured during the testing of this detector are presented.

9058 Some observations on /sup 3/He neutron spectrometry. Evans, A.E. (Los Alamos National Lab., Los Alamos, NM). pp 1343-1346 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The energy resolution of a /sup 3/He ionization chamber, which varies from 13 keV FWHM at 0 keV to approximately 30 keV at 1 MeV, allows observation of false peaks due to the presence of scattering or absorbing materials and due to accidental near-coincidences of the rather long-risetime detector pulses. Pulse-risetime distributions depend on the neutron beam's angle of incidence to the detector axis; ability to separate /sup 3/He-recoil pulses from full-energy /sup 3/He(n,p) pulses diminishes for neutrons of energy greater than 1.5 MeV and incident normal to the detector axis. When high-energy neutrons are present, measurement at a grazing angle is recommended.

9059 High position resolution and accuracy in /sup 3/He two-dimensional thermal neutron PSDs. Fischer, J.; Radeka, V.; Boie, R.A. (Brookhaven National Lab., Upton, NY). pp 129-140 of Position-sensitive detection of thermal neutrons. Convert, P.; Forsyth, J.B. Orlando, FL; Academic Press, Inc. (1983). Contract AC02-76CH00016.

Advances made at BNL in position sensing methods and in gas mixture studies have made possible the development of neutron position detectors with significantly improved position resolution, position accuracy and uniformity of response. A position resolution in the range of 1 - 1.5 mm (FWHM), an integral nonlinearity better than +. 0.1% and uniformity of response of +. 2 - 3% (peak-to-peak) are readily achieved independently of the detector size. These detectors operate at a moderate pressure (5-6 atm) with a /sup 3/He -C/sub 3/H/sub 8/ mixture at very low required avalanche gain ($\approx$ 30) by virtue of the high precision, centroid-finding position readout.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

9060 (AD-A—172432/7/XAB) Preliminary analysis and test results for circuit cards in x-ray and gamma-ray environments. Technical report, 1 March 1984-1 April 1985. Mann, E.B.; Zimmerman, W.R. (Electro Magnetic Applications, Inc., Albuquerque, NM (USA)). 10 Jan 1986. 53p. (EMA—86-R-07). NTIS, PC A04/MF A01.

The measured response of typical circuit cards and simplified circuit cards to ionizing radiation is examined. As in previous tests, the response to the gamma rays is found to be reasonably well understood. The anomalous response to x rays is again observed during and after biasing. For the simplified card, these anomalies are reasonably well understood; however, this is not true for cards with more-complex geometries. Methods for understanding the response of the more-complex cards are discussed.

9061 (INIS-mf—10519, pp 44) Effect of low-background shields on radionuclide analysis. Stanicek, J. (Komenskeho Univ., Bratislava, Czechoslovakia. Matematicko-Fyzikalna Fakulta). Apr 1986. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700408. (CONF-8605203—Absts.).

From IAA '86: conference on instrumental activation analysis; Klucenice, Czechoslovakia (4 May 1986).

9062 (ZfK—579) Radiation damage in silicon detectors. Bischoff, L.; Borany, J. von; Morgenstern, H.; Schmidt, B.; Schubert, D. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1986. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700188.

In this work effects of radiation damage to the properties of Si-nuclear radiation detectors are investigated. Theoretical and experimental investigations were made concerning the influence especially of α-particles (5.5 MeV) and electrons (E/sub max/ = 2.27 MeV) to essential detector parameters, like minority carrier lifetime, energy resolution and counting efficiency of ion-implanted detectors from high resisitivity FZ- and NTD-Si. The medium damage constants are: K/sub tau/ (α) = 3.5 x 10^{-6} cm^2/s, K/sub tau/ (β) = 5 x 10^{-9} cm^2/s. If the oxide passivation layer is irradiated too the damage constants increase of one are two orders of magnitude. The decrease of lifetime at high does leads to a increasing of reverse current and electronic noise. The energy resolution for α-spectrometric measurements at doses of PHI/sub α/ >= 5 x 10^{10} cm^{-2} and PHI/sub e/ >= 5 x 10^{13} cm^{-2} respectively is determined by charge carrier loss on radiation induced defects. The maximum possible irradiation dose for spectrometric detectors amounts 2...5 x 10^{10} cm^{-2} for α-particles and 5...50 x 10^{12} cm^{-2} for electrons. For counting detectors these values increase of one or two orders of magnitude. For radiation damaged detectors a partial or even a complete defect annealing is possible.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 9119, 9778, 9832, 10120

9063 (BDX—613-3615) Optical emission end-of-process detection for plasma cleaning: Topical report. Smith, M.D. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Dec 1986. Contract AC04-76DP00613. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003582.

An end-of-process detector was tested for plasma cleaning operations where organic contamination is removed. The detector uses optical emission spectroscopy to determine the concentration of certain reaction products remaining in the plasma chamber during processing. The output, in strip-chart form, is used to indicate the point at which no further cleaning is being accomplished and thus no further plasma processing is necessary. The oxygen plasma removal of several different organic materials was monitored. Contaminants (paraffin wax and lubricating oil) and polymers (polymonochloroparaxylylene and Kapton polymide) demonstrated completely different removal rates, with each having its own characteristic output curve. Different filters on the detector allowed the monitoring of different wavelengths of light emitting from the plasma. Filters allowing the transmission of light in the wavelenths of 480, 560, and 656 nanometers were tested. These filters correspond to light emitted by activated species of carbon monoxide (480 nm and 560 nm) and hydrogen (656 nm). The hydrogen (656 nm) filter proved to be most sensitive to the removal of the materials being tested. The study demonstrated the usefulness of the detector; however, it does have a major limitation in that it is only effective in monitoring plasma cleaning processes using pure oxygen as the plasma gases. A much more advanced spectrometer being tested in the cleaning of hybrid microcircuits is able to detect, in a similar yet more sophisticated manner, the end-points of plasma processes using gases other than pure oxygen.

9864 (INIS-mf—10511, pp 123) **Liquid sodium oxygen meter development.** Jakes, D.; Kral, J.; Sevcenko, E. Apr 1985. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780030. (CONF-8504277—).

From International symposium on systems with fast ion transport; Smolenice, Czechoslovakia (1 Apr 1985).

9865 (INIS-mf—10512, pp 60) **Environment research by Moessbauer effect.** Wiesinger, G.; Bottig, P.; Ismail, S.S.; Mostafa, A.G.; Grass, F. (Technische Univ., Vienna, Austria. Inst. fuer Experimentalphysik; Faculty of Sciences, Aswan, Egypt. Department of Physics; Atominstitut der Oesterreichischen Universitaeten, Vienna). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

9866 (INS—1983/P-3/E/B) **Linear integrator with a digital display.** Kucharski, J.; Wolski, D. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1983. 49p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

The construction and performance of a linear integrator with a digital display is presented. A set of the CAMAC instrumentation for automatic measurement of a standard deviation is described. Programs for automatic data collection and for calculations of a relative standard deviation are given.

9867 (IPNO-DRE—85-01) **New method for metastable ion studies with a time of flight mass spectrometer. Future applications to molecular structure determinations.** Della Negra, S.; Le Beyec, Y. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750735.

This paper describes a coincidence method for studying metastable ion decompositions with a ^{252}Cf time of flight mass spectrometer. An electrostatic mirror is used to reflect ions which are detected by a set of annular channel plates while neutrals resulting from "in flight" decompositions are counted by channel plates placed behind the mirror. Two simultaneous time of flight (T.O.F.) measurements (ions and neutrals) are recorded event by event using the same start signals. Therefore correlated reflex spectra can be obtained by setting electronically time "windows" on the neutral T.O.F. These windows correspond to masses which have decayed in flight. The charged fragments are then selected in the reflex spectra by this method of coincidences. In flight decays can therefore be identified. Other ionization-desorption techniques can be used as well. A few simple examples are presented.

9868 (IS-T—1214) **Optimization of the analytical performance of an inductively coupled plasma mass spectrometer.** Thompson, J.J. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE87003054.

Methods have been found which enable a commercial inductively coupled plasma mass spectrometer to be used in several useful projects, despite its known susceptibility to ionization suppression and drifting of analyte signal. The optimization of instrument and measurement parameters for particular applications is discussed. The role of ultrasonic nebulization and internal standardization is evaluated. Applications to uranium analysis, stable isotope tracing, flow injection analysis and liquid chromatographic detection are given.

9869 (OEFZS—4366) **On-line coupling of the MAT 251 with a Carlo Erba elemental analyzer for carbon isotope ratio measurements. Examples are shown on lake sediments.** Pichlmayer, F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft). Jun 1986. 19p. (LA—161/86). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700470.

For carbon isotope investigations with a moderate precision demand of about 0.2 per mil in the isotope ratio fast and reliable results are attained by on line combination of the ANA 1500 Elemental Analyzer and the MAT 251 Isotope Mass Spectrometer. The crucial point hereof is the gas splitting device. By proper design and adjustment of the analytical parameters, good sample efficiency and a sharp CO_2 bulk within the He stream is reached. The main characteristics of this combined equipment are described and some isotopic results of organic and anorganic carbon in lake sediment-samples are given as well as deltasup1^{3}C-analyses of spiritous liquors.

9870 (PUC-TN—27/84) **Chamber for uniaxial pressure application at low temperatures.** Grillo, M.L.N.; Carmo, L.C.S. do; Picon, A.P. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica). Aug 1984. 5p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700474.

A chamber for alignment of low temperature ferroelastic domains in crystals by the use of uniaxial stress was built. The system allows the use of EPR and optical techniques, as well as X-ray irradiation at temperatures as low as 77K.

9871 (PUC-TN—28/84) **Microprocessor-based system for automatic X-ray diffraction and fluorescence.** Souza, A.M. de; Carmo, L.C.S. do; Pereira, V.J.E.; Soares, E.A. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil); Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Ciencia dos Materiais e Metalurgia; Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Fisica; Pernambuco Univ., Recife (Brazil). Dept. de Fisica). 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700475.

A data acquisition and processing device appropriate for X-ray analysis and goniometer control was built. The Z-80 based system as well as the whole architeture is described. The advantages and new possibilities of the automated instrument as compared to the traditional ones are listed. The X-ray diffraction and fluorescence techniques can take advantage of the automation.

9872 (ZfK—581) **Coulometric control of hydrogen in sodium and cover gas of sodium loops by solid electrolyte cells.** Teske, K.; Vitke, V.; Glezer, V.; Ul'mann, K.H.; Kuznetsov, Eh.; Kozlov, F.A.; Privalov, Yu.V.; Kon'kov, V.F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.; Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). Mar 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700215.

Results are presented on testing a measuring device for hydrogen in the sodium and cover gas of sodium loops on a laboratory and engineering scale. The hydrogen detector of this device works on the basis of a solid electrolyte cell with coulometric titration of hydrogen in the gas stream. Sensitivity, accuracy, response time and lasting operation of the measuring arrangement have been checked. Possibilities of calibration and testing of the device placed at a stream generator have been examined.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 9507

9873 **(LA-UR—86-4048) Firing complex for explosive pulsed power.** Erickson, D.J.; Freeman, B.L.; Vorthman, J.E.; Caird, R.S.; Fowler, C.M.; King, J.C.; Martinez, A.R.; Repa, J.V.; VanMarter, J.B.; Vaughn, R.G. (Los Alamos National Lab., NM (USA); Vaughn (R.G.) and Associates, Albuquerque, NM (USA)). 1986. Contract W-7405-ENG-36. 9p. (CONF-860703—33). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002891.

From 4. international conference on megagauss magnetic-field generation and related topics; Santa Fe, NM, USA (14 Jul 1986).

A modern firing complex has been constructed for the dedicated development and application of explosive pulsed power (i.e., flux compression generators). The complex consists of three underground and interconnected buildings. The buildings, which employ several types of structural design, are engineered for above ground, open air detonations involving up to 1000 kg (TNT-equivalent) of high explosive. The explosive rating is necessary for the production of electrical pulses with energy content of hundreds of megajoules. 4 refs., 7 figs., 2 tabs.

9874 **(SAND—86-8230) A model for the deflagration of nitramines.** Mitani, T.; Williams, F.A. (Sandia National Labs., Livermore, CA (USA)). Dec 1986. Contract AC04-76DP00789. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003596.

A simplified theoretical model is developed for describing the flame structure and deflagration velocity of steady, planar, adiabatic combustion of nitramines. The model involves exothermic decomposition in a liquid layer, equilibrium vaporization and exothermic combustion in the gas. Judicious selection of energetic and rate parameters on the basis of available experimental information resulted in reasonable agreement between predicted and measured burning rates and pressure and temperature sensitivities.

4502 Nuclear

REFER ALSO TO CITATION(S) 10598, 10599, 10601, 10604, 10605, 10691

9875 **(AD-A—172317/0/XAB) Regional studies with broadband data. Semi-Annual report No. 1, 13 February-30 September 1985.** McEvilly, T.V.; Johnson, L.R. (California Univ., Berkeley (USA). Dept. of Geology and Geophysics). 6 Jun 1986. 37p. (TR—1). NTIS, PC A03/MF A01.

A laterally averaged one-dimensional P and S wave velocity structure is obtained for Silent Canyon Caldera, located beneath Pahute Mesa at the Nevada Test Site. The velocity models are derived from a linearized damped least-squares travel-time inversion for slowness-gradient perturbations. A total of 72 P wave and 20 S wave travel times generated from 13 different explosions, and obtained at scattered locations above the caldera, are used in the inversion. The structure is modeled using linear-velocity gradients. The inversion produces a model which increases in velocity from 1.50 km/sec at the surface to 2.35 km/sec at 2.5 km depth for S waves. The P and S wave models produce travel time residuals typically less than 0.1 and 0.2 seconds, respectively, which is within observational error. However, P-wave amplitude ratios and waveform characteristics of data collected from 7 explosions buried near 625 m depth indicate the presence of lateral variations within the caldera which may be significant to nuclear source studies.

9876 **(AD-A—172450/9/XAB) Responsible soldiering in the nuclear age: inferences from the Catholic Bishop's Pastoral on nuclear war. Master's thesis, August 1985-June 1986.** Smith, M.E. (Army Command and General Staff Coll., Fort Leavenworth, KS (USA)). 6 Jun 1986. 79p. NTIS, PC A05/MF A01.

This thesis is an attempt to develop an ethic for those who must perform soldierly duties in this era. It is an examination of core values, and how these values have been translated into military ethics and obligations within the context of western civilization. This study uses the most recent application of just-war theory, the Catholic Bishop's Pastoral on nuclear war, The Challenge of Peace: God's Promise and Our Response, and compares its instruction to selected findings of another contemporary application, the Nuremberg War Trials. The manner in which we construct and reinforce our moral values in conscience, coupled with appreciation for the sanctity of human existence, evolve as fundamental underlying principles. After having established the scope of authority from which the Catholic Bishop's Pastoral derives its credibility, these principles are compared against the United States Army Ethic and a contemporary ethic is proposed. The study concludes that ultimately we are responsible for the decisions and choices that we make. Soldiers are not absolved, especially within the Judeo-Christian context, from the obligation to make choices based upon sound moral reasoning, simply because they are engaged in activities that run counter to orderly human existence.

9877 **(AD-A—172540/7/XAB) Swirl induced by large area fires. Technical report, 15 November 1984-1 October 1985.** Weihs, D.; Small, R.D. (Pacific-Sierra Research Corp., Los Angeles, CA (USA)). 1 Oct 1985. 23p. (PSR—676). NTIS, PC A02/MF A01.

Swirl has been suggested as the mechanism responsible for high fire-wind velocities and exceptional plume rises from large area fires. The potential sources of vorticity that could result in a swirling central column are examined. Coriolis forces produce only a small tangential velocity component for the time and length scales appropriate to a city size fire. Similarly, asymmetries in fuel load or burning distribution cannot generate sufficient swirl velocities to influence the plume motion or fire-wind velocities. Neither eddies or rotational systems of scale much larger or smaller than the fire radius can produce swirl. Wind systems with wavelength similar in scale to the fire diameter produce only a negligible tangential velocity component. As a consequence, plumes produced by large area fires are not likely to swirl.

9878 **(NVO—277) Long-Term Hydrologic Monitoring Program: Project Gasbuggy Rio Arriba County, New Mexico.** (USDOE Nevada Operations Office, Las Vegas. Health Physics Div.). Oct 1986. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003610.

The Gasbuggy site is located in Rio Arriba County, New Mexico, approximately 55 air miles (88.6 kilometers) east of Farmington, New Mexico. The Gasbuggy device with a yield of 29 kilotons, was detonated December 10, 1967. It was the first US underground nuclear experiment for the stimulation of low-productive natural gas reservoirs. The purpose of the Long-Term Hydrologic Monitoring Program at the Gasbuggy site is to obtain data that will assure the public safety; inform the public, the news media, and the scientific community relative to radiological contamination; and to document compliance with federal, state, and local antipollution requirements. The Gasbuggy site geographical setting, climate, geology, and hydrology are described. Site history, including Gasbuggy event information and Gasbuggy monitoring by the US Public Health is described. Site cleanup activities conducted in 1978 are described. Postoperational surveys indicate that the Gasbuggy site is well below the established decontamination criteria and that no hazard exists or will likely occur during public use of the land surface of the Gasbuggy site.

9879 **Ground motion measurements for the QUESO nuclear event.** Glenn, H.D.; Kalinowski, J.A.; Stubbs, T.F. (Lawrence Livermore National Laboratory, Livermore, CA). pp 639-644 of Shock waves in condensed matter. Gupta, Y.M. New York, NY; Plenum Press (1986). (CONF-850736—).

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

QUESO was a low yield nuclear event detonated at a depth of 216.4 m in hole U10bf at the Nevada Test Site on August 11, 1982. Shock wave histories containing the peak residual stress values were obtained for the first time in free field measurements. Radial and tangential stress measurements indicated a strong residual stress field was induced above the cavity by 200 ms after the nuclear detonation, following rebound of that region after passage of the ground shock. Free field particle velocity profiles corresponded closely with measurements made at comparable ranges in the emplacement hole.

4503 Explosion Detection

9880 (UCID—20930) Regional discrimination of NTS [Nevada Test Site] explosions and western US earthquakes: Multivariate discriminants. Glaser, R.E.; Taylor, S.R.; Denny, M.D.; Vergino, E.S. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01. File Number DE87003602.

Twelve of the earthquake/explosions discriminants outlined in Pomeroy et al. (1982) are evaluated in the western US (WUS). The data consist of 330 NTS explosions and 130 WUS earthquakes in the magnitude range of 2.5 to 6.5 recorded at four broadband seismic stations operated by Lawrence Livermore National Laboratory (LLNL). The stations surround NTS at distances of about 200 to 400 km. The propagation paths for the earthquakes range from approximately 175 to 1300 km and are confined mainly to the Basin and Range. The discriminants tested include m/sub b/ : M/sub s/, relative excitation of short-period SH waves, P/sub n/, P/sub g/, P/sub max/, and L/sub g/ amplitude ratios generation of higher mode surface waves, long period (LP) surface wave energy density, L/sub g/ / R/sub g/ amplitude ratio, excitation of Sn/sub n/, spectral ratios in P/sub n/, P/sub g/ and L/sub g/, third moment of frequency, spectral ratio of LP Love to Rayleigh waves, and Thirlaways's depth discriminant. A multivariate discrimination technique is described that is designed to handle missing data while providing optimum classification of an unknown event based on a given set of discrimination variables. The discrimination variables are first transformed to be insensitive to magnitude, path, or features of the test program. Tests show that the commonly used assumption of equal covariance matrices for the earthquake and explosion populations (resulting in a linear discrimination function) is not valid. However, a quadratic discrimination function is appropriate. An optimality criterion, misclassification cost minimization, is used to select the best set of discrimination variables at each station. Application of the multivariate technique to individual stations shows misclassification rates ranging from 4 to 20% and 4 to 27% for explosions and earthquakes, respectively.

9881 Seismic verification of underground explosions. Glenn, L.A. (Livermore National Lab., Livermore, CA). pp 613-619 of Shock waves in condensed matter. Gupta, Y.M. New York, NY; Plenum Press (1986). (CONF-850736—).

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

The principal tools for monitoring compliance with a comprehensive test ban treaty (CTBT), prohibiting all testing of nuclear weapons, are seismic networks and surveillance satellites. On-site inspections might also be required to resolve ambiguous events. The critical element of the monitoring system is the network of seismic stations, and in particular the in-country station. Internal stations provide much more useful data than do stations outside the borders of testing nations. For large events that are not eliminated by depth or location, one of the most useful discriminants is based on the ratio of surface-wave to body-wave magnitudes (M /sub s/ :m /sub b/). If an explosion and an earthquake have the same body-wave magnitude, the surface-wave magnitude for the earthquake is generally larger. It has yet to be proven that M /sub s/ :m /sub b/ is useful at low magnitudes, expecially when explosions are set off in long tunnels or odd-shaped cavities. A number of other promising regional discriminants have been suggested. Evasion opportunities and cavity decoupling are discussed.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 10114

9882 (CSTB-EN-CLI—84-9) Approach of automatic classification of day meteorological data for energy applications. Sacre, C. (Centre Scientifique et Technique du Batiment, Etablissement de Nantes, 44 (France)). Mar 1984. 17p. (In French). (CONF-8403250—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750436.

From AFME colloquium on meteorology and renewable energies; Valbonne, France (18 Mar 1984).

To facilitate the use of meteorological data as input of energetic systems simulations, the study proposes a methodology to reduce a long time serie of several variables into some typical meteorological days with their frequency distribution and transition probability. For that, we define normalised centred variables which are equal to the difference between observed values and their climatological means, divided by their climatological root mean square. Climatological components are calculated each ten days of year from a 14 years serie long. Then, we can apply a factor analysis and an automatic classification at all days of the sample to find the most frequent typical meteorological days. We show that there are 10 typical meteorological days at Trappes and Carpentras.

9883 (DFVLR-FB—84-42) Prospective investigations with DFVLR-radar of possible relevance in the assessment of radio interference due to scattering from precipitations. Chandra, M.; Schroth, A.; Lueneburg, E. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 25 Oct 1984. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87750807.

First of all, the technical description of the imminent coherent polarimetric DFVLR-radar is provided. The basic radar technique for 'remotely sensing' meteorological precipitations is then generalized and applied to various hydrometeor volumes capable of producing significant electromagnetic scattering. Emphasis is duly given to the anticipated advances the DFVLR-radar will affect on the radar characterization of the distribution and the thermodynamic phase of the hydrometeors. Attention is also directed to the polarimetric capabilities of the radar in characterizing the propagation medium and the 'removal' of propagation effects present in the radar echoes. Finally, we describe a T-matrix method for calculating scattering properties of double-layer hydrometeors. With 12 figs., 3 tabs., 45 refs.

9884 (DOE/ER/60269—2) Coordination for the OHR/ERD R4D program including provision for climatological services 1985-1986: Progress report. Kelley, J.J. (Alaska Univ., Fairbanks (USA). Inst. of Marine Science). Jun 1986. Contract FG06-84ER60269. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003137.

This report covers the period of a six-month grant, January 1 to June 1986 for a project providing coordination in the field for the R4D projects and climatological services. It consists of: (1) scheduling and logistics coordination services; (2) liaison services with industry, government and academic institutions; and (3) Technical Services in the field as requested (regional climatology, atmospheric particulate input).

9885 (DOE/ER/60304—2) Model validation research: Comparison of simulated and observed climate patterns for the past 18,000 years: Progress report for the period February 1, 1986 to January 31, 1987. Webb, T. III. (Brown Univ., Providence, RI (USA). Dept. of Geological Sciences). Dec 1986. Contract FG02-85ER60304. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003373.

Research during 1986 focused on using paleoclimatic data to test the ability of the National Center for Atmospheric Research (NCAR) Community Climate Model (CCM) to simulate past climates. Because changes in the global mean temperature during the past 18,000 years have been similar in magnitude to those predicted for carbon dioxide doubling, the comparison of the model results with paleoclimatic data provides a useful test of the NCAR CCM, which is being used in carbon dioxide research. In particular, the comparison of model results with paleoclimatic data illustrates how sensitively the model responds to past variations in the seasonal radiation budget as well as to changes in other boundary conditions. The four main research tasks included (1) paleoclimatic experiments with the NCAR CCM, (2) data acquisition, analysis, and description, (3) methods development, and (4) comparison of model results with paleoclimatic data.

9886 **(DOE/NBB—0080) An annotated inventory of climatic indices and data sets.** (Oak Ridge National Lab., TN (USA); National Climatic Center, Asheville, NC (USA)). Nov 1986. Contract AC05-84OR21400. 192p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87003292.

This publication describes 34 prominent climatic indices and provides an annotated listing and bibliography of additional indices to help evaluate the effects of increased atmospheric CO2 levels. Examples from the following ten subject areas are included: (1) Global/Hemispheric Data Sets; (2) Marine Data Sets; (3) Long-Term Regional and Local Temperature and Precipitation Data Sets; (4) Atmospheric Constituents Data Sets; (5) Upper Air Data Sets; (6) Southern Oscillation/El Nino Data Sets; (7) Solar Data Sets; (8) Proxy Data Sets; (9) Lake Levels and River Flows Data Sets; and (10) Snowcover and Sea Ice Extent Data Sets.

9887 **(LA-UR—86-3596) Flow visualization experiments on stably stratified flow over ridges and valleys.** Lee, J.T.; Lawson, R.E. Jr.; Marsh, G.L. (Los Alamos National Lab., NM (USA); Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.; Northrop Services, Inc., Research Triangle Park, NC (USA)). 1986. Contract W-7405-ENG-36. 23p. (CONF-8609204—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001972.

From 3. international workshop on wind and water tunnel modeling of atmospheric flow and dispersion; Lausanne, Switzerland (15 Sep 1986).

In laboratory experiments it is not possible to simulate all of the phenomena which affect the flow within a valley. It is especially difficult to simulate Coriolis effects which may be important for large valleys and thermal effects associated with diurnal heating and cooling. However, many aspects of this problem can be studied using nonrotating, isothermal flow over geometrically simple models. This paper summarizes a series of such experiments on the flow over a cosine-shaped ridge and within a valley formed by a pair of such ridges when there is a stable ambient flow normal to the axis of the ridge. Three experimental parameters were varied during the study: the steepness of the ridges, the separation distance between the ridges and the Froude number.

9888 **(NP—7750810) Satellite measurements of the radiation budget: Random sampling test and recovery of the radiation flux density.** Stuhlmann, R. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). 1985. 85p. (In German). NTIS (US Sales Only), MF A01. File Number DE87750810.

First the sampling of 2-D signals by Narrow Field Of View (NFOV) radiometers is discussed. Therefore it is assumed that the statistical properties of the radiance field can be estimated by a Markov-random process. By means of Fourier-transformation "blurring" is defined by the ratio of power of the measured signal and that of the radiance field, where it is assumed that no aliasing noise and no noise introduced by the side bands of the modulation transfer function are present. Thus if the ratio of blurring is equal to one all information about the spatial structure in the radiance field is contained by the recorded signal. It is shown that this ratio reaches the value of 0.95 when the mean width of spatial structure in the radiance field is about ten times larger than the FOV of the instrument. The second part of the study is concerned with the retrieval of broad band exitances from the recorded radiances. Therefore narrow to broad band filter corrections as well as bidirectional reflectance functions are calculated by radiative transfer calculations.

9889 **(NP—7770045) Numerical calculation of pressure drag for typical surface roughness conditions.** Dorwarth, G. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Meteorologisches Inst.). Jan 1986. 168p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87770045.

The pressure drag over irregular terrain is calculated numerically using a non-hydrostatic, two- and three-dimensional simulation model. The calculations prove the correctness of the established theories of drag-inducing processes. In regions with close hill terrain, the drag of the individual hills will be reduced. Three-dimensional hills permit horizontal flow around the topographic elements. In case of hills of oblong shape, drag coefficient are higher for flow the broad side than flow from the narrow side. In case of valleys with stable stratification, the drag coefficient was found to depend also on the ground layer temperature. Only one case of unstable stratification was investigated, i.e. a transient case with ground temperatures increasing with time. The results of the simulations show that high drag may occur in dependence of topography also with convective boundary layers.

9890 **(PNL-SA—13894) A comparison of meso-alpha MLAM model results with observations from CAPTEX [Cross Appalachian Tracer Experiment].** Davis, W.E.; Olsen, A.R.; Didier, B.T.; Damschen, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1986. Contract AC06-76RL01830. 5p. (CONF-861165—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003170.

From 5. joint conference on applications of air pollution meteorology; Chapel Hill, NC, USA (18 Nov 1986).

The purpose of the current study is to apply a meso-alpha multilayer air-mass model MLAM to CAPTEX 3 and 4 with the objectives of (1) gaining insight into the interpretation of surface and aircraft measurements, and (2) identifying key processes that meso-alpha scale models must address. The approach taken is to use the three-dimensional model results to aid in providing a plausible explanation for the observed surface and aircraft measurements. Particular emphasis is given to processes related to the three-dimensional aspects of mixing, transport, and diffusion on the meso-alpha scale. Specific processes discussed are decoupling of the plume from the surface and multilayer transport in conjunction with vertical redistribution of a puff.

9891 **(UCID—20762-Rev.1) A parameterized numerical fit to total column ozone changes calculated by the LLNL 1-D model of the troposphere and stratosphere.** Connell, P.S. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003600.

Economic analysis of the costs and benefits of regulation of chlorofluorocarbon (CFC) emissions with respect to changes in the total atmospheric ozone column abundance depends on the availability of an accurate means to predict future ozone changes as a function of CFC emissions and trends in other atmospheric species. Over about the last decade, these predictive calculations have been made chiefly with one-dimensional numerical models of the stratosphere. Although these models, run time-dependently, are substantially more computationally efficient than the more desirable multidimensional models, they remain expensive from the viewpoint of the requirements of cost/benefit analysis. In this note we present a numerical parameterization of the results of the LLNL one-dimensional model for total column ozone change in terms of surface emissions or abundances of the various source species. Previous versions of the LLNL model have been used in earlier studies to evaluate time-dependent scenarios of future trends in the emissions or atmospheric abundances of CFC-11, CFC-12, CFC-22, CFC-113, CCl_4, CH_3CCl_3, CO_2, CH_4, N_2O, Halon-1301 and Halon-1211. The numerical fit reported here produces calculated ozone changes within about 2% (column ozone change relative to the 1985 model atmosphere) of the current LLNL 1-D model results, for a range of scenarios and ozone changes. It therefore can approximately represent the actual 1-D model for the purposes of economic analysis of regulatory strategies. It is, however, crucial to note that the 1-D model results, and consequently this parameterization, are subject to substantial uncertainties. Future improvements in our knowledge of atmospheric photochemical kinetics and transport in the troposphere and stratosphere should be expected to modify these current results in unpredictable directions.

9892 (UCID—20906) **Stability criteria for the LSDM [Livermore Statistical Dynamic Model].** Taylor, K.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002734.

One criterion for stable integration of zonally averaged primitive equation models is normally given by the Courant-Fridericks-Lewy condition applied to the fastest (horizontally) progagating waves. In practice this means that the horizontally propagating acoustic wave (Lamb wave) limits the length of the time step that can be used in the integration: $\Delta t < \Delta x/c$, where c is the phase speed of the Lamb wave. In the Livermore Statistical Dynamic Model (LSDM) there are other simulated processes that may place more stringent constraints on the length of the time-step. In the attached notes, I have derived the stability criteria for the LSDM. I have found that to a good approximation (within 15%), the length of time-step must be less than Δt/sub c/ where 1/Δt/sub c/ = (1 + γ/2) (1/tau/sub s/ + 1/tau/sub r/) + γ/2 1/tau/sub e/.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 8851, 8852, 9040, 9511, 9577, 9621, 9693, 9886, 9889, 9910, 9979, 10070

9893 (CONF-861044—4) **Examination of the uncertainty in air concentration predictions using Hanford field data.** Miller, C.W.; Fields, D.E.; Cotter, S.J. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002416.

From Hanford Life Sciences symposium: radiation protection-a look to the future - celebrating four decades of research at Hanford; Richland, WA, USA (21 Oct 1986).

The accuracy of an environmental transport model is best determined by comparing model predictions with environmental measurements made under conditions similar to those assumed by the model, a process commonly referred to as model validation. Over the past several years, we have done a variety of validation studies with the popular Gaussian plume atmospheric dispersion model using data from tests conducted on the Hanford reservation. Data for short-term releases of small particles for release heights of 2 m, 56 m, and 111 m have been used. Up to six different sets of atmospheric dispersion parameters and three different atmospheric stability class specification schemes have been examined. Overall, dispersion parameters based on measurements made near Juelich, West Germany, give the best comparisons between observed and predicted air concentrations. The commonly-used vertical temperature gradient method for determining atmospheric stability class consistently gives poor results. The accuracy of air concentration predictions improves when dry deposition processes are included in the model. Further validation studies using various Hanford data sets are planned.

9894 (CONF-870129—1) **Emergency response puff model at the Oak Ridge National Laboratory.** Sharp, R.D.; Kornegay, F.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87001698.

From Society of Computer Simulation emergency planning multiconference; San Diego, CA, USA (14 Jan 1987).

An emergency response computer code has been implemented at the Oak Ridge National Laboratory to assist decision makers during the accidental airborne release of an agent. This paper describes the necessary steps to run the FORTRAN 77 computer program that simulates the movement of a substance over time. This series of steps involves obtaining the appropriate meteorological and other input data for the program execution of the program, and analysis of the results. The computer program runs on the IBM PC and the HP 9000 supermicro computer. Both of these computers communicate with a PDP 11/23, which stores real-time meteorological data, to obtain data necessary to run the computer code.

9895 (CONF-8512105—) **Environmental chemicals - their impacts and pathways.** (Arbeitsgemeinschaft der Grossforschungseinrichtungen (AGF), Bonn (Germany, F.R.)). 1985. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

22 papers were given at the conference and were entered separately in the data base. Topics covered the following fields of environmental chemicals: 1. global distribution and atmospheric chemistry; 2. occurrence and formation in aquatic and terrestrial ecosystems; 3. toxicity and determination methods; and 4. medical aspects.

9896 (CONF-8512105—, pp 5-8) **Climatology and chemistry of tropospheric ozone: Its 'natural' balance and anthropogenic influence.** Volz, A.; Smit, H.G.J.; Kley, D. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

There is evidence that the concentration of tropospheric ozone has increased since the last century. This is indicated by measurements made in 1876/1877 at the Observatoire de Montsouris, Paris which give an average of about 14 ppb, about three times lower than is found today in continental air-masses. Model calculations show, that this increase is most likely due to increasing emissions of NO/sub x/.

9897 (CONF-8512105—, pp 9-11) **Peroxidic products in the decomposition of olefins by ozone.** Gaeb, S.; Hellpointner, E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

The products of the reaction of ozone with selected olefins of biogenic and anthropogenic origin suggest various ways by which peroxidic intermediates may be formed in the environment.

9898 (CONF-8512105—, pp 30-32) **Topical chemical aspects of waste management.** Bahadir, M.; Bieniek, D.; Lahaniatis, E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Waste management is very complex and its various stages may affect the quality of environment considerably. At present technologies in environmental engineering for waste treatment are well developed, however, they are not in a position to reduce the hazardous contents or chemicals in wastes or to eliminate them from the environment completely. During operation these plants may often produce new environmental chemicals which are highly persistent and/or toxic (waste incineration), respectively, may contribute to the accumulation of the already existing pollutants and help to disperse them (waste compost, sewage sludge). Chemical problems of present waste treatment technologies will be explained with examples and the possibilities of an environmentally acceptable waste management will be discussed.

9899 (CORR—84-00250) **Stationary source sampling report: Ambient and source volatile organic compound testing, Production air stripper unit 1 (PASU-1) and pilot air stripper (PAS).** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 5 Sep 1984. Contract AC09-76SR00001. 138p. NTIS, PC A07. File Number DE87003110.

Tests were performed to measure the ambient concentrations of perchloroethylene, trichloroethylene, and 1,1,1-trichloroethane in the A/M area and to determine, for compliance purposes, the emissions and concentrations of those compounds issued from the Production Air Stripper Unit 1 (PASU-1) column and from the Pilot Air Stripper (PAS) column.

9900 (DOE/ER—0299) Carbon dioxide and climate: Summaries of research in FY 1986. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Oct 1986. 110p. NTIS, PC A06/MF A01; GPO Dep. File Number DE87003287.

This Program Summary documents the activities and products of the Carbon Dioxide Research (CDR) Program in Fiscal Year 1986. It includes descriptions of all projects funded. Project descriptions are categorized according to program areas: carbon cycle, climate and first detection, vegetation response, indirect effects, scientific interface, and integration and evaluation.

9901 (DOE/ER/60023—2) Humidity/cloud-radiation feedback and possible climatic perturbations due to fossil fuel utilization: Final report. Wang, W.C.; Molnar, G.; Goldenberg, S. (Atmospheric and Environmental Research, Inc., Cambridge, MA (USA)). Oct 1986. Contract AC02-81ER60023. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002226.

The objectives of this project are (1) to investigate the radiation characteristics of the atmosphere with respect to H_2O, CO_2, O_3, trace gases, aerosols, and clouds for evaluating the greenhouse effect associated with increased atmospheric CO_2, and (2) to determine and evaluate the feedback mechanisms and processes affecting the climate as a result of changes in radiation characteristics. The work has been focused on: (1) reducing the uncertainties of the calculated direct CO_2 radiative effect associated with approximate radiation treatments, (2) improving the understanding of important climate processes (including the vertical and meridional sensible and latent heat fluxes and humidity/cloud-radiation feedbacks), and (3) investigating other climate-related anthropogenic and natural activities so that a proper context for the CO_2-induced climate changes can be provided. These studies are briefly summarized.

9902 (DOE/LC/11049—2205) State-of-the-art evaporation technology: Topical report. Hasfurther, V.R.; Haass, M.J. (Wyoming Univ., Laramie (USA). Dept. of Civil Engineering). Sep 1986. Contract AC20-84LC11049. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87001011.

This report discusses evaporation theory, measurement and estimation as well as the effects of water quality on evaporation. Emissions from waste effluents is also mentioned. The theory and equations to represent evaporation using energy balances, mass transport and the combination of these two methods of analysis are presented in detail. Evaporation meters and other techniques for measuring evaporation are reviewed. A discussion of ways to estimate areal evaporation is presented along with criteria which affects evaporation pond design. The effects of chemical monolayers and salinity on the rate of evaporation is cited and discussed to indicated problems associated with most industrial waste effluents. The problem of monitoring emissions resulting from evaporation ponds associated with industrial waste emissions is also presented.

9903 (EPRI-EA—3221-Vol.5) The Integrated Lake-Watershed Acidification Study: Volume 5, Database documentation: Final report. Valentini, J.L.; Gherini, S.A. (Tetra Tech, Inc., Lafayette, CA (USA)). Oct 1986. 189p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920115.

During the Integrated Lake-Watershed Acidification Study (ILWAS) over 590,000 measurements were made in three hydrologic basins. Basin vegetation, soils, and geologic media were characterized and measurements were made of the quantity and quality of water moving through the basins, from above the forest canopy to the lake outlets. These data were used to support the development of the ILWAS model, which simulated the response of surface waters to acid deposition, and to support topical research on lake-watershed acid-base processes. As prime contractors, Tetra Tech was responsible for compiling the data base and developing the model. The field and laboratory research was conducted by investigators from seven universities and two government agencies. This volume, the fifth in the ILWAS report series, describes the development of the ILWAS Data Base and provides the information necessary for others to use it.

9904 (ORNL/TM—9817) Environmental effects of chlorofluorocarbons: Will restrictions be needed?. Perry, A.M. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002955.

This report describes a method that has been devised for estimating ozone depletion for various assumptions regarding the future release of chlorocarbons (CLCs) to the atmosphere. The method is calibrated against published results obtained with more elaborate models of atmospheric chemistry. The method is applied for various scenarios for future CLC emissions, with and without emission controls. Estimates are made of the climatic effects of CLC emissions, as presented by the average surface temperature of the earth. It is concluded that current rates of emission present no immediate danger to the earth and its inhabitants and would not do so for many decades. However, growth in CLC emissions at 3%/year or more, as seems likely, would eventually lead to unacceptable changes both in total ozone density and in surface temperature. Although no corrective action appears necessary at present, given the long times needed to develop and introduce substitutes or to implement effective emission controls, such actions may be necessary within the next one to three decades.

9905 (PNL-SA—14331) Formaldehyde measurements in five new unoccupied energy efficient manufactured homes. Parker, G.B.; Onisko, S.A. (Pacific Northwest Lab., Richland, WA (USA); USDOE Bonneville Power Administration, Portland, OR). Nov 1986. Contract AC06-76RL01830. 12p. (CONF-8611100—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003300.

From PNWIS/APCA annual meeting; Eugene, OR, USA (19 Nov 1986).

Week-long integrated formaldehyde levels were measured over eight weeks in five new unoccupied energy efficient manufactured homes. These homes were constructed to the specifications set forth in the Model Conservation Standards (MCS) established by the Northwest Power Planning Council for site-built homes. The MCS standards exceed the Housing and Urban Development's (HUD) standards that currently apply to manufactured homes nationwide. Two of the homes were located at Richland, Washington, and three homes were located at Vancouver, Washington. Among other features of the MCS, the homes are equipped with air-to-air heat exchangers (AAHX) to supply additional fresh air ventilation. The first four weeks of testing were conducted with the AAHX off and the second four-week measurement period was conducted with the AAHX continuously on the HI setting. Formaldehyde levels ranged from 0.047 ppM the fifth week of the testing in a double wide home (with the AAHX turned on) to 0.164 ppM in the single wide home in the first week of measurements with the AAHX off. At no time did the formaldehyde levels exceed 0.4 ppM, the HUD targeted indoor level based on HUD codes for formaldehyde emissions from plywood and particle board building materials used in the homes. There was no strong correlation between formaldehyde levels and the measured air exchange rate. 9 refs., 2 figs., 3 tabs.

9906 (UCID—20291-Rev.1) Liquefied Gaseous Fuels Spill Test Facility: Facility description. Johnson, G.W.; Thompson, D.S. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003604.

The Liquefied Gaseous Fuels Spill Test Facility being constructed at the Department of Energy's Nevada Test Site is proposed as the basic research tool for studying the dynamics of accidental releases of various hazardous liquids. This Facility is designed to discharge, at varying discharge rates, measured volumes of liquids that have been stored under cryogenic or ambient conditions onto the surface of a dry lake bed. Performance criteria have been established on the basis of discharges normally expected from transport or storage-type accidents. Facility capabilities include means for the remote control and measurement of test spill operating parameters and for the remote, unmanned acquisition and recording of close-in and downwind gaseous concentrations and meteorological data.

9007 **Method for reduction of SO/sub 2/ emission for fossil fired boiler.** Abrams, J.Z.; Sherwin, R.M. (to Bechtel International Corp., San Francisco, CA). US Patent 4,623,523. 18 Nov 1986. Filed date 18 Mar 1985. v.p.

A method is described for removing sulfur dioxide from a sulfur dioxide-containing flue gas comprising: injecting small particles of an aqueous dispersion of material selected from the group consisting of pressure hydrated lime and pressure hydrated dolomitic lime into a confined zone. The zone is within a flue gas stream flowing in a duct in an amount sufficiently large to reduce the sulfur dioxide content of the flue gas to a level equivalent to between 10% and 90% of the original sulfur dioxide content. The level is sufficiently small so that the aqueous dispersion is completely dried within the confined zone, in a stoichiometric ratio to the sulfur dioxide of not larger than 1.5, wherein the confined zone is spaced-apart from the inside walls of the duct and completely dry.

9008 **The changing carbon cycle: A global analysis.** Trabalka, J.R.; Reichle, D.E. (eds.). New York, NY; Springer-Verlag New York, Inc. (1986). 614p. (DOE/OR/21400—T277). Springer-Verlag New York, Inc., Service Center, 44 Hartz Way, Secaucus, NJ 07094. File Number TI87002362. Contract AC05-84OR21400.

The Sixth Annual Oak Ridge National Laboratory Life Sciences Symposium was devoted to the topic of "The Global Carbon Cycle: Analysis of the Natural Cycle and Implications of Anthropogenic alterations for the Next Century." This volume is the result of the presentations at the symposium, carefully selected and critically reviewed to represent a summary of our understanding of some of the most important scientific issues relative to the global carbon cycle. The book examines current knowledge about the fluxes, sources, and sinks in the global carbon cycle as well as our ability to apply this knowledge to the prediction of changes in atmospheric CO_2 concentration resulting from anthropogenic influences. Separate abstracts have been prepared for individual presentations. (ACR)

9009 **Emissions control through dry scrubbing.** Farber, P.S. (Argonne National Lab., Energy and Environmental Systems Div., 9700 S. Cass Avenue, Argonne, IL). *Environmental Professional, The;* 5: No. 3, 178-183(1986). Contract W-31-109-ENG-38.

Concern with operating problems, and the desire for system simplicity, has resulted in the development of dry scrubbing systems for flue gas cleanup, and their acceptance by industry as an alternate to the conventional wet scrubbers. These dry scrubbing systems incorporate two commonly used pieces of equipment; spray dryers, which have been used for many years to manufacture everything from detergents to powdered milk, and a particulates removal device (either a fabric filter or an electrostatic precipitator). The first application of this technology to removal of sulfur oxides from high sulfur coal combustion gases occurred when Argonne National Laboratory installed a system in 1981 as the control device on its main coal-fired boiler. To date, this type of pollution control system has shown itself capable of meeting state emission standards and, in a special test run, of removing over 90% of the sulfur oxides produced from combustion of a coal with over 4% sulfur.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 9008, 9184, 9217, 9878, 9939, 10047, 10112

9010 **(EGG—10282-1117) Aerial systems support for the Nevada Test Site weapons testing.** Boyns, P.K. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1986. Contract AC08-83NV10282. 8p. (CONF-8609147—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002855.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

EG & G Energy Measurements, Inc. operates two aircraft for the Department of Energy in support of the Nevada Test Site (NTS) activities. A King Air B-200 and a Turbo Beech aircraft are used to perform wind measurements, cloud sampling and cloud tracking operations in support of each test.

9011 **(EGG—10282-1126) Status of aerial survey emergency preparedness and ground support equipment, calibration, and sensitivities.** Dahlstrom, T.S. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1986. Contract AC08-83NV10282. 6p. (CONF-8609147—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002860.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

During the course of EG & G Energy Measurements, Inc. history in aerial surveillance, the scope of response has broadened from routine surveys and accident response with aerial systems, to being prepared to respond to any radiological incident with aerial, ground mobile, and hand-held instrumentation. The aerial survey system presently consists of four MBB BO-105 helicopters outfitted with gamma pods and specialized navigation systems (MRS or URS) that allow the operator and pilot to fly well-defined survey lines. Minimum detectable activities (MDA) for various isotopes range from a few tenths of a mCi to 100 mCI for point sources and from 1 to 200 pCi/g for volume sources.

9012 **(KFK—4108) WOLGA 1 - a FORTRAN 77 program for calculation of the gamma dose rate due to radioactive effluent air released by one or several continuously emitting sources.** Honcu, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung). Aug 1986. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750325.

The WOLGA 1 program serves to calculate the dose rate in the vicinity of one or several emitters continuously releasing gamma active effluent gases. Frequency distributions must be available of the directions of propagation, wind velocities and diffusion categories. The program is also used to calculate the annual impact on the environment by gamma active emissions from the reactors of the Karlsruhe Nuclear Research Center. This task must be solved again every year due to the occasional addition of new emitters and the change of the source strengths, the nuclide mixtures, and the meteorological conditions. The program calculates for any field point the gamma dose rate below the cloud of effluent air from one or several emitters. The possibility exists of establishing a list of dose rates applicable to selected field points (e.g. villages) or an isodose chart. Program input and output are explained by examples.

9013 (NIRS-RSD—66, pp 5-9) **Strontium-90 and cesium-137 in rain and dry fallout (for domestic program) (from April 1983 to January 1984). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Rain and dry fallout were collected monthly on a sampling tray (5000 cm^2) which was filled with water to a depth of 1 cm at the beginning of every month. The sample was then pretreated for radiochemical analysis and the strontium-90 and cesium-137 were separated. The counting of radioactivity was made using low background beta counters for 60 minutes. After corrections for counter efficiency, recovery, self-absorption, and decay, the concentrations of these nuclides in the original samples were calculated. Samplings were made at 22 locations in Japan from Hokkaido to Okinawa. The final results of activities of strontium-90 and cesium-137 are tabulated for each location and month in a unit of mCi/Km^2.

9014 (NIRS-RSD—66, pp 10-12) **Strontium-90 and cesium-137 in rain and dry fallout (for WHO program) (from July 1983 to January 1984). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Rain and dry fallout were collected monthly on a sampling tray (5000 cm^2) which was filled with water to a depth of 1 cm at the beginning of every month. The sample was then pretreated for radiochemical analysis and the strontium-90 and cesium-137 were separated. The counting of radioactivity was made using low background beta counters for 60 minutes. After corrections for counter efficiency, recovery, self absorption, and decay, the concentrations of these nuclides in the original samples were calculated. Samplings were made at 10 locations in Japan excluding Hokkaido and Okiwa. The final results of activities of strontium-90 and cesium-137 are tabulated for each location and month in a unit of mCi/Km^2.

9915 (NIRS-RSD—66, pp 13-14) **Strontium-90 and cesium-137 in airborne dust (from April 1983 to September 1983). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Airborne dust was collected by an electrostatic precipitator or a filter air sampler for every three months at a rate of more than 3000 m^3 per month. The sampling was done 1 to 1.5 meters above the ground at 12 locations in Japan. The ashed samples were pretreated for radiochemical analysis and the strontium-90 and cesium-137 were separated. The counting of radioactivity was made using low background beta counters for 60 minutes. After corrections for counter efficiency, recovery, self-absorption, and decay, the concentrations of these nuclides in the original samples were calculated. The final results of activities of strontium-90 and cesium-137 are tabulated for each location and month; i.e., maximum values are 1 x 10^{-4} pCi/m^3 or so, for Sr-90 and Cs-137 in several sites in Japan.

9916 (NIRS-RSD—68, pp 5-8) **Strontium-90 and cesium-137 in rain and dry fallout for domestic program from November 1983 to July 1984. Environmental and dietary materials.** Mar 1984. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in rain and dry fallout measured throughout Japan each month from November 1983 to July 1984 are given in mCi/km^2. Sampling points are total of 22 from Sapporo (Hokkaido) to Nakagami-gun (Okinawa). Collection and pretreatment of samples, preparation of samples for analysis, separation of strontium-90 and cesium-137, determination of stable strontium, calcium and potassium, and counting are described. Rain and dry fallout was collected monthly on a sampling tray, approximately 5000 cm^2 in area. The sample was then passed through a cation exchange column. After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 minutes.

9917 (NIRS-RSD—68, pp 9-11) **Strontium-90 and cesium-137 in rain and dry fallout for WHO program from January 1984 to July 1984. Environmental and dietary materials.** Mar 1984. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in rain and dry fallout measured throughout Japan each month from January to July 1984 are given in mCi/km^2. Sampling points are total of 10 from Akita (Akita) to Kagoshima (Kagoshima). Collection and pretreatment of samples, preparation of samples for analysis, separation of strontium-90 and cesium-137, determination of stable strontium, calcium and potassium, and counting are described. Rain and dry fallout was collected monthly on a sampling tray, approximately 5000 cm^2 in area. The sample was then passed through a cation exchange column. After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 minutes.

9918 (NIRS-RSD—68, pp 12-13) **Strontium-90 and cesium-137 in airborne dust from October 1983 to June 1984. Environmental and dietary materials.** Mar 1984. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in airborne dust measured throughout Japan from October 1983 to June 1984 are given in pCi/m^3. Sampling points are total of 12 from Futaba-gun (Fukushima) to Nagasaki (Nagasaki). Collection and pretreatment of samples, preparation of samples for analysis, separation of strontium-90 and cesium-137, determination of stable strontium, calcium and potassium, and counting are described. Airborne dust was collected by an electrostatic precipitator or a filter air sampler for every three months at a rate of more than 3000 m^3 per month. The sampling was done 1 to 1.5 meters above the ground. After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 minutes.

9919 (ORNL—5913) **ANEMOS: A computer code to estimate air concentrations and ground deposition rates for atmospheric nuclides emitted from multiple operating sources.** Miller, C.W.; Sjoreen, A.L.; Begovich, C.L.; Hermann, O.W. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 215p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE87002986.

This code estimates concentrations in air and ground deposition rates for Atmospheric Nuclides Emitted from Multiple Operating Sources. ANEMOS is one component of an integrated Computerized Radiological Risk Investigation System (CRRIS) developed for the US Environmental Protection Agency (EPA) for use in performing radiological assessments and in developing radiation standards. The concentrations and deposition rates calculated by ANEMOS are used in subsequent portions of the CRRIS for estimating doses and risks to man. The calculations made in ANEMOS are based on the use of a straight-line Gaussian plume atmospheric dispersion model with both dry and wet deposition parameter options. The code will accommodate a ground-level or elevated point and area source or windblown source. Adjustments may be made during the calculations for surface roughness, building wake effects, terrain height, wind speed at the height of release, the variation in plume rise as a function of downwind distance, and the in-growth and decay of daughter products in the plume as it travels downwind. ANEMOS can also accommodate multiple particle sizes and clearance classes, and it may be used to calculate the dose from a finite plume of gamma-ray-emitting radionuclides passing overhead. The output of this code is presented for 16 sectors of a circular grid. ANEMOS can calculate both the sector-average concentrations and deposition rates at a given set of downwind distances in each sector and the average of these quantities over an area within each sector bounded by two successive downwind distances. ANEMOS is designed to be used primarily for continuous, long-term radionuclide releases. This report describes the models used in the code, their computer implementation, the uncertainty associated with their use, and the use of ANEMOS in conjunction with other codes in the CRRIS. A listing of the code is included in Appendix C.

9920 (PER—98) **Environmental radioactivity at the National Nuclear Research Centre, Pelindaba. Report for the year 1984.** Bain, C.A.R.; Annandale, J.; Moolman, E.W. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). Apr 1986. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700273.

The revised environmental survey programme, introduced during 1970, with the emphasis on monitoring of the critical paths of exposure of the general public, was continued in 1984. Results of determinations of both gross radioactivity and individual nuclides in samples of fish and water (which are critical materials for liquid-effluent releases) from the Hartbeespoort Dam and from the Crocodile River are given and discussed. Results of ^{131}I, ^{90}Sr and gamma-spectrometric analyses of milk, the critical material for releases to the atmosphere, are presented. Results are given of regular investigations of the composition of airborne releases to the atmosphere and liquid-effluent releases to the Crocodile River, performed in order to detect other possible critical nuclides. Levels of deposited and airborne activity from nuclear-bomb tests are reported. Owing to absence of fresh fallout material the levels for most fission products have fallen below the limit of detection. No environmental radioactivity due to releases from the Pelindaba site could be detected above the natural background or accumulated fallout levels. Unplanned releases of UF$_6$ sometimes occur. Accordingly, some of the environmental samples were also analysed for uranium. The results obtained so far do not indicate an increase in uranium levels in the environment.

9921 (SCPRI-RM—1-1986) **Monthly results of measurements, January 1986.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Feb 1986. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750743.

Measurement tables concerning the surveillance of the environment in France.

9922 (SCPRI-RM—2-1986) Monthly results of measurements, February 1986. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Mar 1986. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750770.

Measurement tables concerning the surveillance of the environment in France.

9923 (SCPRI-RM—3-1986) Monthly results of measurements, March 1986 with 1. Quarterly progress report 1986. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Apr 1986. 46p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750771.

Measurement tables concerning the surveillance of the environment in France with supplement related to the three months, January, February, March 1986.

9924 (UCRL—95562) The current status of ARAC [Atmospheric Release Advisory Capability] and its application to the Chernobyl event. Gudiksen, P.H.; Sullivan, T.J.; Harvey, T.F. (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 8p. (CONF-861007—15). NTIS, PC A02. File Number DE87002558.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

The Atmospheric Release Advisory Capability (ARAC) project, developed by the Lawrence Livermore National Laboratory (LLNL), provides real-time dose assessments and estimates of the extent of surface contamination that may result from an atmospheric release of radioactivity. It utilizes advanced computer-based data communication and processing systems to acquire the meteorological and source term information needed by the three-dimensional atmospheric dispersion models to derive the consequence assessments. The ARAC responded to the recent Chernobyl reactor accident in the Soviet Union by estimating the source term and the radiation dose distribution due to exposure to the radioactive cloud over Europe and the Northern Hemisphere. This analysis revealed that approximately 50% of the estimated core inventories of I-131 and Cs-137 were released. The estimated committed effective dose equivalent due to inhalation of radioactivty during cloud passage is of the order of 10 mrem within parts of Scandinavia and eastern Europe, while most of the populations within central Europe were exposed to levels ranging from 1 to 10 mrem. The amount of Cs-137 released by the Chernobyl accident far exceeds that released by previous reactor accidents, but is only about 6% of the Cs-137 produced by the atmospheric weapon testing programs. 9 refs., 4 figs., 2 tabs.

5004 Thermal Effluents Monitoring And Transport

9925 (SFB—210/E-18) Wind tunnel experiments on cooling tower plumes. Pt. 1. In uniform cross flow. Andreopoulos, J. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerk). Jan 1986. 101p. NTIS (US Sales Only), PC A06/MF A01. File Number DE87750813.

Measurements of velocity and temperature field and flow visualization results are reported for an ideal case of a cooling-tower plume in the presence of a uniform cross flow for various velocity ratios, densimetric Froude numbers, and Reynolds numbers. Coherent structures in the form of jet-like, wake-like or mushroom type of vortices have been observed. The type of the structures depends primarily on the velocity ratio. As the Reynolds number increases turbulent structures appear, which carry vorticity of the same sign as the partner vortices in the low Reynolds number case. The measurements showed that there is a strong interaction between the bending over plume or jet and the wake of the cooling tower is basically responsible for the downwash effect. The latter is generally quite strong at low velocity ratios and high Reynolds numbers. High turbulence intensities are produced in the wake of the tower for a distance 6 to 8 diameters. The plume is diluted faster as the velocity ratio increases and buoyancy decreases. In the wake region of the stack dilution increases with increased buoyancy.

5006 Regulations

REFER ALSO TO CITATION(S) 9234

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 9244, 9956

9926 (AECL—8902) Computed tomography of drill cores. Taylor, T. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700264.

A preliminary computed tomography evaluation of drill cores of granite and sandstone has generated geologically significant data. Density variations as small as 4 percent and fractures as narrow as 0.1 mm were easily detected.

9927 (EGG—10282-2124) Survey of potential habitat for the endangered San Joaquin kit fox (Vulpes macrotis mutica) in the Carrizo Plain, San Luis Obispo County, California. Kato, T.T. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). Oct 1986. Contract AC08-83NV10282. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003158.

A field study was conducted for the US Fish and Wildlife Service to determine the presence and distribution of the endangered San Joaquin kit fox (Vulpes macrotis mutica), and to map land use patterns on the Carrizo Plain, eastern San Luis Obispo County, California. The survey was conducted in July 1985 and covered approximately 8140 acres in 20 sections of land. A total of 41 kit fox dens were found. The highest number of kit fox dens observed per 1000 acres was 12; the lowest was 1.5. Approximately 29,720 acres (49%) were grazed by cattle and sheep, 25,600 acres (42%) were cultivated for dry-land farming, but land use was not determined for 5560 acres (9%).

9928 (INP—1222/AP) Remarks on some rock neutron parameters. Czubek, J.A. (Institute of Nuclear Physics, Krakow (Poland)). 1983. 74p. (CONF-8311142—2). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700217.

From IAEA consultants meeting on nuclear data for borehole and bulk-media assay using nuclear techniques; Cracow, Poland (14 Nov 1983).

A method to calculate the thermal neutron parameters (absorption cross-section, diffusion coefficient and diffusion length) of rocks is given. It is based on a proper energy averaging of cross-sections for all rock matrix and rock saturating liquid constituents. Special emphasis is given to the presence of hydrogen. The diffusion lengths in different lithologies in the function of the variable rock porosity have been calculated. An influence of the thermal neutron spectrum on the shape of the porosity calibration curves for the dual spacing neutron method is shown. This influence has been estimated on two porosity units, on average.

9929 (PPA-BEN—3, pp 58-68) Neutron activation analysis and its applications in geology. Wan Fuad Hassan; Mohd Suhaimi Hamzah. (National Univ. of Malaysia, Bangi, Selangor. Geology Dept.). 1985. (In Malay). NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

In this paper the author revises the uses of Neutron Activation Analysis (NAA) in geology, such as i) NAA for Analysis techniques ii) in Geochemistry studies iii) Minerals and iv) mining industry.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 8890, 9895, 9898, 9903, 9906, 9978, 10066

9930 (CONF-8512105—, pp 12-14) **Evaluation of trace analytical methods for the examination of environmentally relevant heavy metals.** Stoeppler, M. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

The selection of trace analytical methods for routine applications considering the individual matrix and element aim, analytical reliability, time consumption and costs will be discussed. Recommendable for this purpose are various modes of atomic absorption spectroscopy and voltammetry but also plasma induced atomic emission spectroscopy and a rather new more sensitive version of X-ray fluorescence. Indispensable for the current accuracy control of the applied procedures are additional methods like mass spectrometric isotope dilution analysis and neutron activation analysis as well as the use of reference materials.

9931 (CONF-8512105—, pp 33-35) **Transferability of laboratory tests to field conditions in the soil/plant system.** Scheunert, I. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

The determination of physico-chemical substance properties of chemicals in the laboratory can be used for the prediction of mobility and leaching of chemicals in soil as well as of their volatility from soil, if these physico-chemical properties are combined with relevant environmental parameters to form a model. Whereas abiotic conversions, also, can be described by models in most cases, this is possible for biotic conversions only in case of a few simple reactions. The whole of the conversion reactions occurring in soil and plants, as well as the mineralization effected by the whole of soil microorganisms, can be determined only experimentally thus far. The extrapolation of spatially and temporarily limited laboratory experiments determining conversion and mineralization to outdoor conditions is possible only if both the influence of spatial extent of the experimental unit and the time-course of the reactions are known. Coarse predictions based on empirical correlations are possible for one vegetation period. The uptake of chemicals by plants from soil is a complex process which can be predicted fairly well by the molecular weight of the compounds. The quantitative extrapolation of laboratory tests to environmental conditions is limited.

9932 (CONF-8512105—, pp 61-63) **Testing for mutagenic activity in agricultural soils, surface waters and waste waters.** Goeggelmann, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

During the past decade the application of short-term bioassays in the fractionation and analysis of complex environmental mixtures have led to the detection of mutagenic compounds for example in water, airborne particles and food. The Salmonella assay is the most used and recommended method for the initial screening of mutagenic activity, especially in complex mixtures. The present study was undertaken to analyse the mutagenicity of samples of various agricultural soils and surface waters.

9933 **(NP—7750802) Nuclear absorption and emission spectroscopy - analyses for elements and trace elements in forest ecosystem sampling solutions.** Heinrichs, H.; Koenig, N.; Schultz, R. (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1985. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750802.

Berichte des Forschungszentrums Waldoekosysteme/Waldsterben. Vol. 8.

The publication abstracted points out the basic methodological principles and problems of spectroscopic analysis and gives detailed descriptions of the methodological chemical analysis of aluminium, calcium, cadmium, cobalt, chromium, copper, iron, pottassium, magnesium, manganese, sodium, nickel, lead and zinc in different sampling solutions.

9934 **(TVA/PUB—87/7) Report on the remedial action to isolate DDT from people and the environment in the Huntsville Spring Branch, Indian Creek System, Wheeler Reservoir, Alabama: Review panel activities, (United States v. Olin Corporation consent decree), May 31, 1983-June 30, 1986.** (Environmental Protection Agency, Atlanta, GA (USA). Region IV). Jul 1986. 146p. NTIS, PC A07/MF A01. File Number DE87900334.

The Consent Decree requires the Olin Corporation to develop and implement a remedial plan that will meet a performance standard of 5 parts per million (ppM) of DDT in fillets of channel catfish, largemouth bass, and smallmouth buffalo in specified reaches of the HSB-IC System. This performance standard is to be achieved by a remedy that is consistent with the goals and objectives of the Consent Decree. A Review Panel, consisting of members from the United States Environmental Protection Agency (EPA), Tennessee Valley Authority (TVA), United States Fish and Wildlife Service (FWS), the Department of the Army (DA), the State of Alabama (ADEM), and nonvoting participants from the town of Triana, Alabama (Triana), and the Olin Corporation (Olin), was established by the Consent Decree. Review Panel responsibilities include technical overview and approval of Olin's proposals to achieve the requirements of the Consent Decree. This report summarizes the activities of the Review Panel associated with implementation of Consent Decree requirements from May 31, 1983 through June 30, 1986.

9935 **(UCID—20775) Testing underground tanks for leak tightness at LLNL.** Henry, R.K.; Sites, R.L.; Sledge, M. (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1986. Contract W-7405-ENG-48. 339p. NTIS, PC A15. File Number DE87003586.

Two types of tank systems are present at the Livermore Site: tanks and associated piping for the storage of fuel (forty-three systems), and tanks or sumps and associated piping for the retention of potentially contaminated wastewater (forty systems). The fuel systems were tested using commercially available test methods: Petro-Tite, Hunter Leak Lokator, Ezy-Chek, and Associated Environmental Systems (A.E.S.). In contrast to fuel tank systems, wastewater systems have containers that are predominantly open at the top and not readily testable. Therefore, a project to test and evaluate all available testing methods was initiated and completed. The commercial method Tank Auditor was determined to be appropriate for testing open-top tanks and sumps and this was the method used to test the majority of the open-top containers. Of the 81 tanks tested, 61 were found to be leak tight, 9 were shown to have leaks, and 11 yielded inconclusive results. Two tanks have not yet been tested because of operational constraints; they are sheduled to be tested within the next two months. Schedules are being developed for the retesting of tanks and for remedial actions.

9936 **Effects of acidic deposition on atmospheric deterioration of materials.** Lipfert, F.W. (Brookhaven National Lab., Building 475, Upton, NY 11973). pp 17 of Proceedings of the technical symposium of Corrosion 86. Houston, TX; National Association of Corrosion Engineers (1986). (CONF-860304—).

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Most common construction materials deteriorate in the outdoor atmosphere, due to the combined actions of "natural" weathering and atmospheric contaminants. Interest in materials damage and corrosion includes the effects of acidic precipitation in addition to the effects of gaseous and particulate air pollution. Assessing the relative importance of these usually additive effects requires damage functions, relating loss of a given material to specific agents in the atmosphere. Damage functions have been estimated for zinc (galvanized steel), copper, aluminium, carbon steel, and calcareous stones. Some of these functions are linear, i.e., proportional to pollutant concentrations and to time; some are decidedly non-linear. All have intercepts or constant terms that incorporate non-specific deterioration effects, i.e., natural weathering. The relative importance of local vs. regional air pollution or precipitation chemistry in this context requires consideration of atmospheric transport, as well as the linearity of the damage function (determines whether multiple sources have additive effects). The location of pollution sources relative to population centers (where materials are also concentrated) is seen to be important in the overall assessment of costs and benefits of pollution control. This paper draws on examples and case studies prepared for the National Acid Precipitation Assessment Program and 1985 Current Damage Assessment.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 8922, 8923, 8933, 8997, 8998, 9187, 9878, 9920, 9921, 9922, 9923, 9988, 9997, 10104, 10105, 10112

9937 (CEA-R—5354) **Humic acids and their interactions with metallic elements: Cu II, Eu III, Th IV, U VI: contribution of size exclusion chromatography method and research of complexation models.** Lesourd-Moulin, V. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 304p. (In French). NTIS (US Sales Only), PC A14/MF A01. File Number DE87750721.

The interest given to natural organic matter (humic and fulvic acids) as complexing agents of metallic ions in soils and natural waters becomes more and more important in environmental area. Cation - humic matter interactions have a great importance, a better understanding of the contribution of these substances in natural media specially towards radioactive elements with long life time. Interactions are studied by a chromatographic technique of gel filtration: the dynamic equilibrium method is based on the separation of the formed complex (humic macromolecule - metallic ion and the free metallic ion, which due to its size penetrates totally in the pores of the gel. Separation mechanisms of the chromatographic support and the contribution of each parameter, are studied as a function of the buffer nature, its concentration, the PH, the gel porosity and the valence of the metallic cation. This study led to the determination of the appropriate experimental conditions for each cation. A study of metallic binding with humic acid has been undertaken with Cu^{2+}, Eu^{3+}, Th^{4+}, $Uo_2{}^{2+}$. These elements, except copper, have been chosen for their properties similar to the transuranic elements. Different samples of humic acids (commercial, podzolic soil, rendzine soil) are also studied. A deeper research of europium - humic acid interactions by means of different treatment models (discrete or gaussian models) has been undertaken in order to determine the number, the binding site strength and the global interaction constants.

9938 (CEA-R—5358) **Some observations on plutonium transfers in human and animal food-chains and Gi tract: plutonium complexation parameters.** Bittel, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). Jun 1986. 69p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750741.

Although many data have been accumulated concerning the distribution of Pu in waters, soils, and foodchains, recent studies have raised the question of the Pu physico-chemical species and their differential availability. Accordingly, we reviewed published data on the transfer of Pu in foodchains and in the gastrointestinal tracts. Dietetic, physico-chemical, biochemical and microbiological parameters have been studied and their incidence on the intestinal transfer factor f_1 of Pu in man briefly discussed: the transfer in the trophic chains often increases Pu mobility and perhaps f_1. Experimental research is needed to obtain quantitative data.

9939 (CONF-8609191—3) **Global cycling of tritium and iodine-129.** Kocher, D.C.; Killough, G.G. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001678.

From Seminar on the cycling of long-lived radionuclides in biosphere: observation and models; Madrid, Spain (15 Sep 1986).

Dynamic linear compartmnt models are used widely to describe global cycling of environmental tritium and ^{129}I. Important tests of these models by comparison of predictions with environmental data from anthropogenic sources are discussed. A tritium model, based on the global hydrologic cycle that reproduces time-series data from atmospheric nuclear weapons testing on concentrations in precipitation, ocean surface waters, and surface fresh waters in the northern hemisphere, concentrations of atmospheric tritium in the southern hemisphere, and the latitude-dependence of atmosperic tritium in both hemispheres is presented. The model includes: hemispheric stratosphere compartments; disaggregation of the troposphere and ocean surface waters into eight latitude zones; consideration of the different concentrations of water in air over land and the ocean in calculating the specific activity of atmospheric tritium; and use of a box-diffusion model for transport in the ocean. An important prediction of a global model for ^{129}I, which we developed previously from data on cycling of naturally occurring stable iodine, is that the mean residence time in the first 1 m of surface soil is about 4000 y. However, a recent analysis of measured soil profiles of ^{129}I near the Savannah River Plant, based on a linear compartment model for downward transport through soil, suggested that the mean residence time in the first 0.3 m is only about 40 y. A diffusion model is used to describe the measured soil profiles, and the resulting diffusion coefficient is shown to correspond to mean residence times in the first 0.3 m and 1 m of soil of about 80 and 900 y, respectively. The value for the first 1 m can be reconciled with the prediction of the global model.

9940 (EPRI-CS—4839) **In situ vitrification of PCB [polychlorinated biphenyl]-contaminated soils: Final report.** Timmerman, C.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 34p. NTIS, PC A03/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. File Number DE87003328.

In Situ Vitrification (ISV) is a patented process developed by Pacific Northwest Laboratory for the US Department of Energy as an in-place stabilization technique for radioactive contaminated soils. In addition, the process is being evaluated for potential application to soils contaminated with hazardous wastes, such as PCBs. An engineering-scale ISV test with PCB-contaminated soil has been successfully performed for the Electric Power Research Institute to determine the fate of PCBs when the process is applied. Small process off-gas releases of 0.05% can be effectively retrained by a conventional treatment system, which utilizes a carbon filter. Limited amounts of PCBs (0 to 0.7 ppM) were detected in the surrounding soil and none were founded in the vitrified block, indicating that migration away from the vitrification zone during processing may not be a significant concern. Initial testing has determined the technical applicability of ISV to soil sites contaminated with 500 ppM PCBs. 7 refs., 6 figs., 4 tabs.

9941 (IAE—3880/3) **On chamber models of radionuclide migration in food chains.** Bykov, A.A.; Demin, V.F.; Murzin, N.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1984. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700220.

Qualitative analysis of stationary and dynamic chamber model applicability for the description of radionuclide migration in food chains is given. Conclusions are made on the principles of chamber quantity choice for the food chain model. Variety of possible solutions for the dynamic chamber model is illustrated by the example of radionuclide migration in the three-level food chain. 25 refs.; 8 figs.

9942 (INIS-mf—10514, pp vp) **Modelling and prediction of radionuclide migration from shallow, subgrade nuclear waste facilities in arid environments.** Smith, A.; Ward, A.; Geldenhuis, S. (Steffen, Robertson and Kirsten, B.C., Vancouver, B.C., Canada; Steffen, Robertson and Kirsten, Mining Inc., Johannesburg, South Africa). Aug 1986. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700294. (CONF-860909—Absts.).

From Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86); Cape Town, South Africa (7 Sep 1986).

9943 (NIRS-RSD—66, pp 18-20) **Strontium-90 and cesium-137 in soil (from June 1983 to September 1983). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Results are presented for the determination of strontium-90 and cesium-137 in soils in Japan. Twenty-seven sampling points were selected all over Japan from Hokkaido to Okinawa by the criteria that the points were spacious and flat without past disturbance and those located in a forest, in a stony area or inside of river banks should be avoided. Soils were taken from two layers of depth, 0 to 5 cm and 5 to 20 cm. After drying, soils were passed through a 2 mm sieve and were employed for radiochemical leaching, separation, and purification of strontium-90 or cesium-137. Radioactivity of strontium-90 or cesium-137 was determined with a low background beta counter normally for 60 minutes. Determined values are presented as pCi/kg and mCi/km^2 for two different depth layers. As for strontium-90 contents, they were ranged from 13.0 +- 3.3 pCi/kg-dry (Aomori, 5 to 20 cm) to 1300 +- 20 pCi/kg-dry (Oota, Shimane Pref., 0 to 5 cm), or from 1.1 +- 0.14 mCi/km^2 (Tsuyama, Okayama Pref., 0 to 5 cm) to 50.0 +- 1.7 mCi/km^2 (Sapporo, 5 to 20 cm). As for cesium-137 contents, they were ranged from 0.5 +- 2.2 pCi/kg-dry (Saga, 5 to 20 cm) to 4700 +- 40 pCi/kg-dry (Oota, Shimane Pref., 0 to 5 cm) or from 0.1 +- 0.42 mCi/km^2 (Saga, 5 to 20 cm) to 120.0 +- 2.0 mCi/km^2 (Oota, Shimane Pref., 5 to 20 cm), and the variance for cesium-137 values were larger than those for strontium-90. Seasonal or local tendency for the contents of the two nuclides were not clarified.

9944 (NIRS-RSD—66, pp 23-24) **Strontium-90 and cesium-137 in sea sediments (from July 1983 to September 1983). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Results are presented for the determination of strontium-90 and cesium-137 in coastal sea sediments of 12 sampling points all over Japan from Hokkaido to Okinawa in July, August and September, 1983. Sampling of the sea sediments was carried out under the following criteria: place of more than 1 meter of water depth at low tide, no significant sediment movement observation in the vicinity of concern, and preferable sampling of mud, silt, and fine sands. After removing foreign substances, radiochemical pretreatment for separation of strontium-90 was carried out and also for cesium. Radioactivity of strontium-90 or cesium-137 was determined with a low background beta counter normally for 60 minutes. As for strontium-90 contents, they were ranged from 0.0 +- 3.0 pCi/kg-dry (off Niigata Port, Niigata Prefecture) to 15.0 +- 3.9 pCi/kg-dry (at Mutsu Bay, Aomori Prefecture) and the average value was 3 pCi/kg-dry. As for cesium-137 contents, their variance was large and the value ranged from 8.0 +- 2.6 pCi/kg-dry to 190.0 +- 8.0 pCi/kg-dry (both at Mutsu Bay) and the average value was 65 pCi/kg-dry. Seasonal variance or differences among sampling points were not clarified both for strontium-90 and cesium-137, and it is speculated that the determined values were not abnormal in general.

9945 **(NIRS-RSD—66) Radioactivity survey data in Japan.** (National Inst. of Radiological Sciences, Chiba (Japan); Japan Chemical Analysis Center, Chiba). Sep 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

Individual papers are processed for the data base. (PSB)

9946 (NIRS-RSD—68, pp 18-19) **Strontium-90 and cesium-137 in soil from May 1984 to July 1984. Environmental and dietary materials.** Mar 1984. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in soil measured throughout Japan from May to July 1984 are given in pCi/kg and mCi/km^2. Sampling points are total of 8 from Kawabe-gun (Akita) to Ibasuki-gun (Kagoshima). Collection and pretreatment of samples, preparation of samples for analysis, separation of strontium-90 and cesium-137, determination of stable strontium, calcium and potassium, and counting are described. Soil was collected from the location in the spacious and flat area without past disturbance on the surface. Soil was taken from two layers of different depths, 0 aproximately 5 cm and 5 approximately 20 cm. After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 minutes.

9947 **(NIRS-RSD—68) Radioactivity survey data in Japan.** (National Inst. of Radiological Sciences, Chiba (Japan); Japan Chemical Analysis Center, Chiba). Mar 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

Individual papers are processed for the data bases. (PSB)

9948 **(OEFZS—4369) Environmental radioactivity and its impact on agriculture. I. The behaviour of radionuclides in soils and plants.** Haunold, E.; Horak, O.; Gerzabek, M. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft). Aug 1986. 48p. (In German). (LA—163/86). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700216.

As a consequence of the reactor-accident of Chernobyl the environmental radioactivity in Austria increased far above the level recorded before. Depending on the amount of precipitation the deposition of radioactive fallout showed great differences. By the contamination of agricultural products, the radionuclides, above all Cs-137 and Cs-134, can enter the foodchains. This paper reviews prevailing results concerning the behaviour of radionuclides in soil and their uptake by plants. Soil-plant transfer factors are presented for the most important types of crops. With reference to fresh weight and vegetative plant matter, the range for Cs is between 0.01 and 0.03, for Sr between 0.1 and 1.2. The application of transfer calculations in practice is discussed.

9949 **(ORNL—6146) The long-term problems of contaminated land: Sources, impacts and countermeasures.** Baes, C.F. III. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 133p. NTIS, PC A07/MF A01; GPO Dep. File Number DE87002969.

This report examines the various sources of radiological land contamination; its extent; its impacts on man, agriculture, and the environment; countermeasures for mitigating exposures; radiological standards; alternatives for achieving land decontamination and cleanup; and possible alternatives for utilizing the land. The major potential sources of extensive long-term land contamination with radionuclides, in order of decreasing extent, are nuclear war, detonation of a single nuclear weapon (e.g., a terrorist act), serious reactor accidents, and nonfission nuclear weapons accidents that disperse the nuclear fuels (termed "broken arrows").

9950 **(YJT—85-38) Sorption of cesium, strontium, iodine, nickel and carbon in mixtures of concrete, crushed rock and bitumen.** Hietanen, R.; Alaluusua, M.; Jaakkola, T. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Sep 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750408.

Sorption of Cs-134, Sr-85, I-125, Ni-63 and C-14 on simulated mixtures of materials present in the repositories for low and medium level wastes were studied. Samples were selected according to the Finnish plans for the repositories. The components of the mixtures were crushed rock, concrete (IVO and TVO) and bitumen (TVO) to be used as waste package, backfill and construction material. The ground water used was collected from the planned disposal sites for the low and medium level wastes. The solution-to-solid mass-ratios (V/M) have been chosen to simulate the conditions prevailing in repositories. The Ksub(d)-values of the mixtures were determined by the batch method. The Ksub(d)-values of the mixtures were also calculated using the relative mass of each component and the Ksub(d)-values determined for each component separately. The effect of concrete water as well as the correction due to the ratio of the liquid volume to solid mass (V/M-ratio) was taken into account in the determinations of the calculated Ksub(d)-values. The experimental Ksub(d)-values of cesium were 10 - 115 and 1 - 3 ml/g for TVO's and IVO's mixtures, respectively. The calculated Ksub(d)-values were 2 - 26 times higher than the experimental Ksub(d)-values. The experimental and calculated Ksub(d)-values of strontium, iodine and nickel were the same order of magnitude. The Ksub(d)-values of strontium were about 1 - 16 ml/g. Low sorption of iodine in all samples was found, the Ksub(d)-values were < 0.6 ml/g. The Ksub(d)-values of nickel were 2 - 15 ml/g. The experimental Ksub(d)-values of carbon were 0.1 - 12 ml/g. The calculated Ksub(d)-values of carbon were lower than the experimental Ksub(d)-values. The effect of V/M on Ksub(d) of sample mixtures was low for Sr. For cesium and iodine the Ksub(d) was lower by a factor of 5 for the V/M ratio 0.28:1 than 10:1. For nickel and carbon the Ksub(d)-values were 1 - 3 orders of magnitude smaller for low V/M ratio (0.28:1).

9951 (YJT—86-02) Review of the sorption data of the main radionuclides in low and intermediate level nuclear wastes for Finnish bedrock. Pinnioja, S.; Hietanen, R.; Alaluusua, M. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Jan 1986. 120p. (In Finnish). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750410.

This report summarizes the studies on sorption of radionuclides in Finnish bedrock performed at the Department of Radiochemistry University of Helsinki. Sorption data for backfill and construction material are also included. Samples represent common rocks, minerals, construction and backfill materials at the sites in the proposed repositories for low and intermediate level nuclear wastes at Haestholmen (IVO) and Olkiluoto (TVO). Sample types used for sorption experiments were crushed rock and concrete, mineral and rock thin sections, rock pieces, 'drill core cups' and natural fracture surfaces. The method used for determination of Ksub(d)-values was the batch method. The determination of Ksub(a)-values was performed by the autoradiographic method. The radionuclides discussed in this report are ^{134}Cs, ^{85}Sr, ^{89}Sr, ^{58}Co, ^{63}Ni, ^{125}I, ^{99}Tc and ^{14}C. Recommended sorption data (Ksub(d) and Ksub(a)-values) for use in safety analyses in migration modelling are presented. For conservative evaluation the values selected are minimum values from two or three parallel determinations. When only one Ksub(a)-value of radionuclide was available for a rock species that value was considered as recommended value.

9952 (YJT—86-14) Diffusivity of cesium, strontium, carbon and nickel in concrete and mixtures of sodium bentonite and crushed rock. Muurinen, A.; Penttilae-Hiltunen, P.; Rantanen, J. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Jul 1986. 86p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750404.

The engineering barriers suggested to be used for the disposal of low and intermediate level wastes in Finland are concrete and crushed rock or mixtures of crushed rock and bentonite. In the repository the barriers are saturated by groundwater and radionuclides may be released by diffusion through the barries. For safety analysis, the mechanisms by which the nuclides migrate and corresponding parameters should be known. In this study diffusion measurements on different types of concrete and mixtures of sodium bentonite and crushed rock were carried out. Radioactive isotopes of cesium, strontium, carbon and nickel were used as tracers. The apparent diffusivities (Dsub(a)) were evaluated on the basis of the measurements. The apparent diffusivity of cesium in concretes was $10^{-14}...10^{-15}m^2/s$. Strontium was mainly sorbed on cement where it diffuses slowly. Part of strontium propably penetrates in the rock ballast by diffusion. The diffusivities of carbon and nickel in the concrete was low. The upper limit was evaluated to be Dsub(a) $< 10^{-14}m^2/s$. The diffusivity of cesium in the mixtures of crushed rock and bentonite varies between 0.5×10^{-12} and $7 \times 10^{-12}m^2/s$. Cesium was mainly sorbed on the rock. The diffusivity of strontium was $2 \times 10^{-11}...2 \times 10^{-12}m^2/s$. Strontium was mainly sorbed on bentonite. The diffusion of the sorbed ions (surface diffusion) seems to be a additional migration mechanism in the case of cesium and strontium in the mixture of bentonite and crushed rock. The diffusivity of carbon in the mixtures of crushed rock and bentonite was $6 \times 10^{-11}...4 \times 10^{-12}m^2/s$. No sorption was found in the case of carbon. The measured Dsub(a) of nickel in the mixtures of crushed rock and bentonite was $4 \times 10^{-14}...2 \times 10^{-15}m^2/s$. The experimental arrangement was not, however, in the stationary state and the more correct values would propably be $10^{-13}...10^{-14}m^2/s$.

9953 (ORNL/tr—86/55) Geochemical distribution of plutonium and americium in Palomares soil. Iranzo, E.; Mingarro, E.; Salvador, S.; Iranzo, E.E.; Rivas, P. (Oak Ridge National Lab., TN (USA); Junta de Energia Nuclear, Madrid (Spain)). 1986. Contract AC05-84OR21400. Translation source information not available . (CONF-8609191—1-Trans.). 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002424.

From Seminar on the cycling of long-lived radionuclides in biosphere: observation and models; Madrid, Spain (15 Sep 1986).

An aerial accident on January 17, 1966, over the Palomares (Almeria) region, caused four thermonuclear bombs to be dropped, resulting in fractionation of two of them and ignition of part of their core components. The aerosol created by this accident contaminated 226 hectares of cultivated and unimproved calcareous-silicic land. The soil in each of the parcels of land has been divided into nine parts in order to analyze the distribution of transuranides from particles of less than 5 microns to those of more than 1 mm in size. Studies have been made of the chemical and mineral composition of the soil, and through radiographic techniques it has been determined that the minerals most responsible for actinide retention are iron oxides, carbonates and phyllosilicates. In addition, studies were made to determine the electrochemical potential and chemical composition of equilibrium waters obtained by maceration of soils from each parcel.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 9237

9954 (UCRL—15858) Seismic exposure comparison report and spectra report: [Final report]. (Geomatrix Consultants, Inc., San Francisco, CA (USA)). Jul 1985. Contract W-7405-ENG-48. 88p. NTIS, PC A05. File Number DE87002691.

The following studies are reported: (1) a comparison between the LLNL/Woodward-Clyde and the 1983 TERA seismic hazard studies; and (2) probabilistic earthquake hazard spectra for the LLNL site for several return periods. Separate abstracts have been prepared for the individual reports. (ACR)

5106 Regulations

REFER ALSO TO CITATION(S) 10003

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

9955 (CONF-8505326—1) The role of stream biota in watershed processes. Cummins, K.W. (Maryland Univ., Frostburg (USA). Appalachian Environmental Lab.). Jun 1986. Contract FG05-85ER60301. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002874.

From Chaparral ecosystems research conference; Santa Barbara, CA, USA (16 May 1985).

The linkage between stream biota and the bank (riparian) vegetation is an essential and tight association in small (orders 1 to 4), running water systems. This critical association can be observed in watersheds covering the full range of thermal and hydrologic patterns. Coarse particulate detritus derived primarily from terrestrial streamside vegetation is processed in the stream channel - that is, converted to fine particulate detritus, respired CO_2, and living organism biomass. The terrestrial-stream interchange is a two way process associated with seasonal temperature and flow cycles. Thus stream organisms utilizing detritus ultimately of terrestrial origin, change both the size and quality of the particulate organics. This material generally reaches a higher quality condition more rapidly than that confined to the soil litter. In addition to the two-way interaction that is processing terrestrially-derived litter and yielding qualitatively changed material to the flood plain at high flows, the stream biota play a significant role in the entrainment and retention of dissolved and particulate organics within a given stream reach.

9956 (DOE/ER—0254) Program plan and summary, remote fluvial experimental (REFLEX) series: Research experiments using advanced remote sensing technologies with emphasis on hydrologic transport, and hydrologic-ecologic interactions. Wobber, F.J. (USDOE Office of Energy Research, Washington, DC. Ecological Research Div.). Oct 1986. 76p. NTIS, PC A05/MF A01; GPO Dep. File Number DE87003219.

This document describes research designed to evaluate advanced remote sensing technologies for environmental research. A series of Remote Fluvial Experiments (REFLEX) - stressing new applications of remote sensing systems and use of advanced digital analysis methods - are described. Program strategy, experiments, research areas, and future initiatives are summarized. The goals of REFLEX are: (1) to apply new and developing aerial and satellite remote sensing technologies - including both advanced sensor systems and digital/optical processing - for interdisciplinary scientific experiments in hydrology and to hydrologic/ecologic interactions; (2) to develop new concepts for processing and analyzing remote sensing data for general scientific application; and (3) to demonstrate innovative analytical technologies that advance the state of the art in applying information from remote sensing systems, for example, supercomputer processing and analysis.

9957 (DOE/ER/60301—1) Thermal-nutritional regulation of functional groups in running water ecosystems: Informal technical progress report, year 2, January 1, 1986-September 30, 1986. Cummins, K.W.; Wilzbach, M.A. (Maryland Univ., Frostburg (USA). Appalachian Environmental Lab.). 1 Oct 1986. Contract FG05-85ER60301. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003321.

The interaction between food quality and growth of representatives of the shredder, collector and scraper functional groups was studied. Three procedures were developed for separating populations of stream macroinvertebrates into groups of individuals which exhibit differential mortality. The differences in survival observed in these population components under the conditions of controlled growth experiments are due to pathogenic infection by anaerobic bacteria. The suspected pathogens are routinely present in the digestive tracts of stream invertebrates. Infection is most likely to occur at molting, the specific sites of infection probably being lesions developing at the junction of the midgut and hindgut when the lining of the hindgut is shed. 4 figs., 4 tabs.

9958 (DOE/ER/60311—2) Nutrient recycling on the southeastern US continental shelf: Progress report, March 1, 1985 to February 28, 1987. Hanson, R.B. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 31 Oct 1986. Contract FG09-85ER60311. 101p. NTIS, PC A06. File Number DE87002483.

During the present contract year, time was spent processing: (1) SPREX nitrogen recycling data, (2) PreSPREX bacterial growth and production, (3) SPREX bacterial growth and production, (4) BIOTRANS nitrogen recycling, (5) GALE nitrogen recycling, and (6) COASTAL BOUNDARY ZONE (CBZ) nitrogen recycling. During SPREX, rates of ammonium utilization and regeneration were determined. The results indicate that more than enough ammonium nitrogen was regenerated to support the measured rates of primary production in the CBZ. However, the rates of ammonium uptake and regeneration were not balanced. Picoplankton were responsible for regenerating nearly all of the ammonium, and nanoplankton consumed most of the regenerated nitrogen. In addition, it appeared that phytoplankton were able to utilized ammonium when deprived of light and were not physiologically nitrogen limited. During Pre-SPREX, becterial dynamics were determined in the Coastal Boundary Zone. BIOTRANS is ongoing and measurements include ammonium utilization and regeneration in the water column and sediments. Estimates of ammonium diffusion and flux from sediments are also being determined temporally and spatially. On the GALE Cruise, nitrogen recycling was measured to obtain data on winter rates in coastal and shelf waters off Georgia and South Carolina. We are continuing our spatial study of nitrogen recycling in the sediments of the Coastal Boundary Zone off South Carolina, Georgia, and Florida.

9959 (TR-EL—82-4/82-11-43) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Florida): Spotted seatrout. Johnson, D.R.; Seaman, W. Jr. (Florida Univ., Gainesville (USA)). Aug 1986. 26p. NTIS, PC A03/MF A01. File Number TI87900140.

The spotted seatrout (Cynoscion nebulosus) is an estuarine-dependent species of sport and commercial importance. Populations do not exhibit great movement and tend to be isolated from each other in coastal bays of south Florida. Depending on temperature and salinity, spotted seatrout may spawn in the spring, summer, or fall. They mature when 200 to 250 mm long (SL), during their second and third summers of life. Fecundity may exceed 1,000,000 eggs. The buoyant eggs sink when salinity falls to 25 ppt. In the summer yound seatrout inhabit shallow, vegetated bays. Older individuals move to deeper waters in winter. Strong schooling behavior is exhibited. Longevity is about 9 years. From 1953 to 1982 commercial landings fell from 3.6 million to 2.5 million pounds annually. The best data on sport harvest and population dynamics are for the populations in extreme south Florida.

9960 (TR-EL—82-4/82-11-52) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Florida): Gray, lane, mutton, and yellowtail snappers. Bortone, S.A.; Williams, J.L. (University of West Florida, Pensacola (USA). Dept. of Biology). Jun 1986. 25p. NTIS, PC A02/MF A01. File Number TI87900139.

These four snapper species have similar morphologies as well as life history and environmental requirements. With some exceptions they are restricted to tropical and subtropical coastal areas of the western Atlantic. Adults often associate with coral reef and other hard-bottom communities. Juveniles and pre-adults usually inhabit shallow, inshore areas and are often found in seagrass beds. Reproduction usually takes place offshore in the warmer months of the year. Fecundity is positively related to female body size, but there is substantial variation both within and among the species. Juveniles obtain adult body proportions at about 50 mm SL. Approximate total maximum lengths of adults are 900 mm for gray snapper, 446 mm for lane snapper, and 750 mm for mutton and yellowtail snappers. Otoliths are the most preferred body part used to determine age. Most snappers attain sexual maturity after 3 to 5 years at a size range of 180 to 350 mm FL. Males mature at a smaller size than females. Recent commercial catches of gray and lane snappers have been increasing, whereas mutton and yellowtail snappers show no clear trends. Sport fishing probably has a substantial impact on the stocks of all four species. All four snappers feed predominantly on small benthic fishes and crustaceans, but yellowtail snapper feed on more pelagic animals. Upper water temperature tolerance limits are 27.2 to 32.5°C and lower limits are 11 to 14°C.

9961 (TR-EL—82-4/82-11-53) Species profiles: Life histories and environmental requirements of coastal fish and invertebrates (North Atlantic): Softshell clam. Newell, C.R.; Hidu, H. (Maine Shellfish Research and Development, Damariscotta (USA); Maine Univ., Orono (USA). Dept. of Animal and Veterinary Sciences). Jun 1986. 23p. NTIS, PC A02/MF A01. File Number TI87900138.

The softshell clam, Mya arenaria, is a commercially and recreationally important invertebrate that inhabits the bottom sediments of subtidal and intertidal waters of moderate to high salinity. Its range is limited by water temperatures too low for reproduction in the north and by lethal warm temperatures in the south. Clams feed by siphoning seawater and removing food particles, especially phytoplankton, with their gills. Clams are therefore sensitive to factors affecting water quality, including suspended sediments, salinity, water temperature, oxygen, and waterborne pollutants. The clam life cycle consists of mass spawning and external fertilization, the development of pelagic larvae, settlement and metamorphosis into spat, and rapid juvenile growth to maturity. Clam recruitment and the migration of spat are dependent upon inshore currents. High morality of eggs, larvae, and spat is largely offset by high reproductive potential. As the clam grows, it finds refuge from most predators deep in the sediments, but it also loses its ability to burrow and is subject to suffocation by siltation. Sediment types, currents, and tidal heights all affect clam growth rates.

9962 (TR-EL—82-4/82-11-54) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Florida): Southern, gulf, and summer flounders. Gilbert, C.R. (Florida State Museum, Gainesville (USA)). Jul 1986. 34p. NTIS, PC A03/MF A01. File Number TI87900137.

The southern, gulf, and summer flounders live most of their lives in or near estuaries. Adults migrate into offshore waters during fall and winter, where spawning occurs from September to April. Eggs and newly-hatched larvae are carried inshore into estuaries, where further growth takes place. Age at sexual maturity for the three species has been estimated from 2 to 4 years, and maximum longevity from 3 to 10 years. Females apparently live slightly longer than males. Southern and summer flounders are estimated to live slightly longer than the smaller gulf flounder. Postlarvae eat mostly zooplankton, and larger individuals feed on fish and crustaceans. The summer and gulf flounders prefer a hard and/or sandy substrate, whereas the southern flounder is more common in a soft bottom of rich organic mud, clay, or silt. The southern flounder, unlike the other two species, is highly euryhaline, and frequently occurs in fresh water. Commercial catch statistics lump the three species together under the name "flounder." Peak commercial catch in the Gulf of Mexico (in 1977) was 1.5 million lb, for a value of $561,000; peak catch in the south Atlantic region (also in 1977) was 11.4 million lb, for a value of $5,100,000.

9963 (TR-EL—82-4/82-11-55) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico): Blue crab. Perry, H.M.; McIlwain, T.D. (Gulf Coast Research Lab., Ocean Springs, MS (USA)). Jun 1986. 27p. NTIS, PC A03/MF A01. File Number TI87900136.

The blue crab, Callinectes sapidus, is common in tidal marsh estuaries and coastal waters of the Gulf of Mexico, occupying a variety of habitats depending upon the physiological requirements of each particular stage in its life history. Spawning occurs from spring through fall in high salinity estuarine and/or coastal waters. Development through the 7 zoeal stages requires approximately 31 days and occurs offshore. The megalopal stage is usually completed within a week. Recruitment to the estuary occurs during the megalopal stage. Molt to the first crab takes place within the estuary. Juveniles exhibit wide seasonal and areal distribution. Growth is rapid and blue crabs in the Gulf of Mexico may reach maturity within a year. Factors affecting growth and survival include food availability, predation, substratum, available habitat, temperature, salinity and pollutants. Blue crabs do not conform to specific trophic levels and are characterized as opportunistic benthic omnivores. Their diverse feeding habits and their importance as prey species for a variety of organisms make them an integral part of coastal ecosystems.

9964 (TR-EL—82-4/82-11-56) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): Alewife/blueback herring. Mullen, D.M.; Fay, C.W.; Moring, J.R. (Maine Univ., Orono (USA). Maine Cooperative Fishery Research Unit). Jul 1986. 28p. NTIS, PC A03/MF A01. File Number TI87900135.

The alewife and blueback herring (Alosa pseudoharengus and Alosa aestivalis) are important species in estuarine and marine ecosystems, though both anadromous and landlocked populations exist. Some individuals mature by age 3, and all mature by age 5. Repeat spawning is common. Spawning environments range from streams only a few centimeters deep to large rivers. Alewives will also spawn in ponds with an open connection to the sea. Blueback herring prefer spawning sites with fast currents and associated hard substrates, while alewives select a wider variety of sites, from standing water and oxbows to mid-river areas. Spawning occurs from April to July in the north Atlantic region; the onset and peak of alewife spawning precede those of blueback herring by 2 to 3 weeks. Larvae and juveniles remain in or near areas spawned before emigrating (as juveniles) to coastal areas in their first year. Emigration is apparently triggered by heavy runoff from rain and/or sharp decreases in water temperature. Adults overwinter offshore to depths of at least 110 m. Nantucket Shoals, Georges Bank, and the Gulf of Maine are important overwintering grounds. Commercial and limited recreational fisheries for these species occur; total US landings in 1982 were 5682 t, while foreign landings within the US Fishery Conservation Zone were 2.0 t. Some eggs can hatch at water temperatures between 7° and 29.5°C, but temperatures above 29.7°C are lethal. Larvae need temperatures greater than 10°C for proper development.

9965 (TR-EL—82-4/82-11-57) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): American oyster. Burrell, V.G. Jr. (South Carolina Wildlife and Marine Resources Dept., Charleston (USA). Marine Resources Research Inst.). Jul 1986. 24p. NTIS, PC A02/MF A01. File Number TI87900134.

The American oyster, Crassostrea virginica, is an important commercial and recreational species. Spawning occurs continuously in warmer months. Larvae are planktonic and are distributed throughout estuaries by tidal currents. After a 2- to 3-week planktonic stage, larvae permanently attach to a solid substrate. In the South Atlantic region, this solid substrate is usually the shell of other oysters growing in the intertidal zone. This gregarious behaivor results in formation of massive intertidal reefs that are a prominent feature of high salinity bays, creeks and sounds in the region. These reefs serve as habitat and foraging grounds for other species. Oysters tolerate salinity from about 5 ppt to above 40 ppt and temperatures from below freezing to nearly 50°C.

9966 (TR-EL—82-4/82-11-58) Species profiles: Life history and environmental requirements of coastal fishes and invertebrates (South Florida): King mackerel and Spanish mackerel. Godcharles, M.F.; Murphy, M.D. (Florida Dept. of Natural Resources, St. Petersburg (USA). Div. of Marine Resources). Jun 1986. 26p. NTIS, PC A03/MF A01. File Number TI87900127.

This Species Profile on king and Spanish mackerel summarizes the taxonomy, morphology, distribution, life history, fishery descriptions, ecological role, and environmental requirements of these coastal pelagic fish to assist environmental impact assessment. King and Spanish mackerel support major commercial and sport fisheries in south Florida. In 1974 to 1983, Gulf of Mexico and Atlantic commercial landings of king mackerel declined from 10.4 to 4.3 million lb.; Spanish mackerel have fluctuated between 4.9 to 17.4 million lb. Both inhabit coastal waters, but Spanish mackerel are generally found closer to beaches and in outer estuarine waters. Both species feed principally on estuarine-dependent species. They are highly migratory, exhibiting seasonal migrations to winter feeding grounds off south Florida and summer spawning/feeding grounds in the northern Gulf of Mexico and off the Atlantic coast of the Southeastern US. Spawning occurs from March/April through September/October between the middle and Outer Continental Shelf (35 to 183 mi) for king mackerel and the inner shelf (12 to 34 mi) for Spanish mackerel. King mackerel reach sexual maturity in their 3rd and 4th years and Spanish, between their 2nd and 3rd. Female king mackerel live longer and grow larger and faster than males. Spanish mackerel live to 8 years; females also grow faster than males. King and Spanish mackerel feed principally on schooling fishes. Larvae and juveniles of both species are prey to little tunny and dolphin; adults are prey for sharks and bottlenose dolphin. Temperature and salinity are important factors regulating mackerel distribution.

9967 (TR-EL—82-4/82-11-59) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): American shad. Weiss-Glanz, L.S.; Stanley, J.G.; Moring, J.R. (Maine Univ., Orono (USA). Maine Cooperative Fishery Research Unit). Jul 1986. 24p. NTIS, PC A02/MF A01. File Number TI87900128.

After a drastic decline in abundance, the American shad (Alosa sapidissima) is being restored in many of the rivers along the East Coast that originally supported large runs. The American shad is an anadromous fish that lives several years in the ocean and returns to its natal river to spawn in the spring when temperatures reach 12°C. The eggs are carried by currents downstream from spawning sites in large rivers for 8 to 12 days until they hatch. The larvae, which metamorphose to the juvenile stage in 3 to 4 weeks, remain in the river until fall when they migrate to the sea. Shad move offshore and southward during winter at water temperatures of 3 to 15°C. American shad feed on zooplankton. They adapt readily to fresh- or saltwater, but they prefer salinities exceeding 4 ppt.

9968 **(TR-EL—82-4/82-11-60) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Steelhead.** Barnhart, R.A. (Humboldt State Univ., Arcata, CA (USA). California Cooperative Fishery Research Unit). Jun 1986. 27p. NTIS, PC A03/MF A01. File Number TI87900129.

The steelhead Salmo gairdneri, an anadromous rainbow trout, supports an important sport fishery in the Pacific Southwest. Although native populations of steelhead have declined, these fish annually enter coastal streams from northern to southern California in years when winter stream flow is high. Steelhead ascend coastal streams from the ocean to spawn in cool, well-oxygenated waters with suitable depth, current velocity, and gravel size. After hatching, steelhead fry emerge from the gravel and begin a freshwater rearing phase that generally extends from 1 to 3 years. Rearing habitat with proper environmental conditions is extremely important to steelhead production. Excessive sedimentation reduces food production, pool depth, and cover - all important to juvenile steelhead survival. Steelhead smolts migrate during spring to saltwater, where most of their growth and sexual maturity is attained in 1 or 2 years. Attempts have increased to protect wild steelhead stocks, to maintain existing spawning and rearing habitat, to restore or enhance degraded habitat where feasible, to use artificial propagation efficiently, and to establish fishing regulations that provide quality angling for steelhead.

9969 **(TR-EL—82-4/82-11-61) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Florida): Spiny lobster.** Marx, J.M.; Herrnkind, W.F. (Florida State Univ., Tallahassee (USA). Dept. of Biological Science). Aug 1986. 28p. NTIS, PC A03/MF A01. File Number TI87900130.

The Florida spiny lobster (Panulirus argus) supports major commercial fisheries in south Florida and the Caribbean Sea. Its life history includes several life stages that live in the open ocean, inshore bays, and coastal reefs. The Florida population spawns along deeper offshore reefs in spring and early summer. Fate of locally spawned larvae is uncertain, but significant postlarval recruitment may originate from larvae spawned in foreign waters. After settlement in inshore vegetated habitats, juveniles reach legal harvestable size in about 2 years. The onset of maturity is coincident with a marked emigration offshore. Subsequent seasonal movements cued by reproductive activity and weather disturbances are pronounced. Excessive fishing has caused a decline in the size of the south Florida population and a corresponding reduction in total spawn. The relevance of spawn reduction is uncertain because of questions regarding larval origins and stock-recruitment relations. Water temperatures probably regulate population distribution and the seasonal dynamics of growth and reproduction. Postlarval recruitment is limited to high salinity inshore environments. Hydrodynamic stimuli and water circulation patterns play critical roles throughout the life cycle.

9970 **(TR-EL—82-4/82-11-63) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): Dungeness crab.** Pauley, G.B.; Armstrong, D.A.; Heun, T.W. (Washington Univ., Seattle (USA)). Aug 1986. 28p. NTIS, PC A03/MF A01. File Number TI87900132.

The Dungeness crab (Cancer magister) is found off the coasts of Washington, Oregon, and southern British Columbia, as well as in the estuarine waters of this geographic area. It is a shellfish highly prized and sought after by both commercialand sport fishermen. In Washington and Oregon, only male crabs may be retained by sport and commercial fishermen. Commercial crab catches are highly variable from year to year, but the catches from Washington and Oregon follow a very similar pattern. The highest sport catches take place on low tides ranging from -0.60 to -0.74 m. Dungeness crab go through a life cycle that involves several metamorphic stages: zoea, megalops, postlarval crab, and adult crab. Hatching success decreases as water temperature increases from 10 to 17°C; the optimal temperature for larval crabs is between 10 and 14°C. Salinity is not as important to egg development and hatching as temperature, but optimum hatching occurs at about 15 ppt.

9971 **(TR-EL—82-4/82-11-64) Species profile: Life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico): American oyster.** Stanley, J.G.; Sellers, M.A. (Maine Univ., Orono (USA). Maine Cooperative Fishery Research Unit; Maine Univ., Walpole (USA). Ira C. Darling Center for Research, Teaching, and Service). Jul 1986. 31p. NTIS, PC A03/MF A01. File Number TI87900133.

The American oyster, Crassostrea virginica, is an important commercial species. Spawning occurs repeatedly during warmer months with millions of eggs released. Embryos and larvae are carried by currents throughout the estuaries and oceanic bays where they occur. The surviving larvae cement themselves to a solid object, where they remain for the remainder of life. Unable to move, they must tolerate changes in the environment that range from -2 to 36°C (air temperature), 2 to 40 ppt salinity, and clear or muddy water. The density and occurrence of adults is limited by predators, chiefly oyster drills, whelks, fish, and crabs.

9972 **(TR-EL—82-4/82-11-65) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): American oyster.** Stanley, J.G.; Sellers, M.A. (Maine Univ., Orono (USA). Maine Cooperative Fishery Research Unit; Maine Univ., Walpole (USA). Ira C. Darling Center for Research, Teaching, and Service). Jul 1986. 31p. NTIS, PC A03/MF A01. File Number TI87900126.

The American oyster (Crassostrea virginica) is an important commercial and mariculture species. It is the dominant species in many bays and oyster shells form extensive reefs that modify sedimentation and local currents. Spawning occurs repeatedly during warmer months with millions of eggs released. Embryos and larvae are carried by currents throughout the estuaries and oceanic bays where oysters occur. The few surviving larvae cement themselves to solid objects for the remainder of life. Unable to move, they must tolerate changes in the environment that range from -1.7° to 49°C, 5 to 30 ppt salinity, and clear to muddy water. The distribution and abundance of adults are limited by marine predators, so that oysters are limited largely to brackish waters.

9973 **(TR-EL—82-4/82-11-66) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): Sand lance.** Auster, P.J.; Stewart, L.L. (Connecticut Univ., Groton (USA)). Jun 1986. 17p. NTIS, PC A02/MF A01. File Number TI87900125.

The systematic classification of the sand lances Ammodytes americanus and Ammodytes dubius is confusing because of overlapping meristic values. In this report, all sand lances in the North Atlantic area off the coast of the US are treated as a combined group (Ammodytes spp.). Sand lances occur in estuarine, open coast, dand offshore habitats. They are important prey to many commercially and recreationally valuable fish and marine mammals. Spawning occurs principally inshore between November and March. Larvae are found along the coasts to the edge of the Continental Shelf. Sand lances occur in schools of from tens to tens of thousands of individuals. They are planktivorous predators; copepods are their major prey item. To rest and to take refuge from predators, sand lances burrow into sand substrates. One to three-year-old fish dominate populations. Growth rate probably increases from the New York Bight to the Nova Scotia banks. Exploitation of sand lances off the Northeast coast of the US is presently only for baitfish.

9974 (TR-EL—82-4/82-11-67) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): Sea scallop.** Mullen, D.M.; Moring, J.R. (Maine Univ., Orono (USA). Maine Cooperative Fishery Research Unit). Aug 1986. 20p. NTIS, PC A02/MF A01. File Number TI87900124.

The sea scallop, Placopecten magellanicus, is a commercially important shellfish found from North Carolina to the Gulf of St. Lawrence in intertidal to deep waters. Scallops spawn at age 1 from July to October, releasing up to one million eggs each year. Up to 8 cm in size, scallops are active in response to disturbances, but those over 9 cm in size do not move. The US commercial fishery has been active for over 100 years, and landings in 1982 were 9700 t, valued at $78 million. Over 75% of the commercial landings of all scallops occur in New England, principally in Massachusetts. Scallops are collected by commercial dredges and scuba divers. A wide variety of animals prey on scallops, and predation by several species of fishes may increase following injuries caused by commercial dredges.

9975 (TR-EL—82-4/82-11-68) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Softshell clam.** Abraham, B.J.; Dillon, P.L. (Hampton Univ., VA (USA). Dept. of Biological Sciences; Hampton Univ., VA (USA)). Aug 1986. 24p. NTIS, PC A02/MF A01. File Number TI87900123.

The softshell clam supports the third most valuable commercial clam fishery in the United States. Density is highest at depths of 3 to 4 m, temperatures less than 28°C, and salinities greater than 3 ppt. Its near-shore habitat makes it easily threatened by pollution. Clam beds in some places have been closed because of contamination by bacteria. Softshell clams are more sensitive to oil pollution than are the other clams that share its habitat. The softshell clam spawns in spring (sometimes in early summer) and again in fall. In 36 to 48 h after fertilization, a pelagic veliger larva develops and persists for 2 to 6 weeks. Then it settles out of the plankton. It attaches to the substrate and can move and reattach itself. Eventually, it adopts the adult lifestyle and occupies a permanent burrow, usually in sandy bottom with less than 50% silt. Adult clams feed by filtering small particles from the water column. Predators of adult clams include crabs, fish, birds, and raccoons. The 24-h LC_{50} values for summer-acclimated clams have been reported as 32.5 to 34.4°C. Juveniles and adults can withstand long periods of anaerobiosis.

9976 (TR-EL—82-4/82-11-69) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): Amphipods.** Grosse, D.J.; Pauley, G.B.; Moran, D. (Washington Univ., Seattle (USA). Cooperative Fishery Research Unit; Fish and Wildlife Service, Slidell, LA (USA). National Wetlands Research Center). Aug 1986. 21p. NTIS, PC A02/MF A01. File Number TI87900122.

Amphipods are ubiquitous in distribution. Hyperiidea are the third most abundant coastal marine crustacean zooplankton, following copepods and euphausids. Benthic Gammaridea are an invaluable food source for many economically important fish and invertebrate species. Lifestyles of the major amphipod groups are varied. On the basis of the Index of Relative Importance (IRI), they comprise more than half of the total IRI spectrum for 38 of 55 fish species in the Strait of Juan de Fuca. They are reported to be indicators of heavily polluted areas.

9977 (YJT—86-11) **Lavia test borehole - a summary of the groundwater investigations in 1984-1985.** Wickstroem, P.; Lampen, P. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Jun 1986. 79p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750406.

In the spring of 1984, a 1001 m deep test borehole with a diameter of 56 mm was core-drilled in a granitic intrusion in Lavia in southwestern Finland. The drilling fluid which was taken from the borehole well was labelled with a stable tracer, i.e. an iodine. Gas-lift pumping by nitrogen gas was carried out after the drilling 1984 and in the spring 1985. The groundwater samples were taken with the equipment developed for deep boreholes. The equipment comprises straddle paker system with a membrane pump and a flow-through-cell system with electrodes. Specific conductivity, amount of dissolved oxygen, pS, pH, temperature and redox-potential of the groundwater samples were measured in this system. Sampling procedure and data acquisition will be controlled by a microcomputer. The groundwater samples were taken four times at different depths during 1984 - 1985. Sampling was made from 5.4 metre packer-isolated zones from the depths 94 - 99 m, 119 - 124 m, 422 - 427 m, 547 - 552 m, 905 - 910 m and 965 - 970 m. At the depth of 9971 - 1001 m only a single packer was used. The consentration of iodine was frequently controlled during the sampling. Groundwater samples were taken for different physico-chemical analyses. Also samples for isotope and noble gas analyses were taken. The iodine analyses gave the evidence that varying amounts of drilling fluid remain in the bedrock. The analyses manifest that the groundwater of the test borehole has quite a low ionic strength. The measurements of the redox-potential and the amount of dissolved oxygen indicate that reducing conditions seem to exist at the depths of 422 - 427 m and 905 - 910 m. A percussion borehole was drilled near the test borehole without using any drilling fluid. Water samples that had not been contaminated by drilling fluid were taken once.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 9507, 9511, 9895, 9898, 9902, 9903, 9930, 9932, 10068

9978 (AD-A—172105/9/XAB) **Management of leadchate from Army sanitary landfills. Final report.** Gardiner, W.P.; Maloney, S.W. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Jul 1986. 82p. (CERL-TR-N—86/19). NTIS, PC A05/MF A01.

Leachate production--the dissolution of soluble constituents and the introduction of microbial byproducts into water--is a natural consequence of operating a sanitary landfill. The amount and characteristics of the leachate produced depend primarily on the contents of the wastes being disposed, the geologic and hydrologic characteristics at the disposal site, the precipitation pattern, and the region's climate. Generally, the potential for leachate formation is greatest in humid areas where rainfall is plentiful, and in landfills where groundwater lies near the surface. All Army landfills, whether old or new, closed or active, generate leachate. However, those with the greatest potential for producing leachate are on installations in the eastern and southeastern sections of the country and on the West Coast--areas where rainfall is significant. This report provides information on landfill leachate management that will be useful to installation environmental coordinators and other management personnel. the information will be helpful for identifying leachate problems and locating data and technical assistance for solving these problems. Information is also provided to help personnel who must establish a new sanitary landfill requiring leachate control or investigate possible problems with older or inactive landfills.

9979 (CONF-8512105—, pp 15-18) **Experiments performed for studying atmospheric input of heavy metals into the German Bight.** Stoessel, R.P.; Michaelis, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

A reliable ecological assessment of the atmospheric transport of heavy metals into the North Sea is strongly impeded by the lack of comprehensive experimental data on both wet and dry deposition. As a contribution to the tackling of this rather complex problem samples of precipitation and particle-size separated airborne particulates are being collected on the island of Pellworm in the eastern part of the German Bight. The present paper briefly sketches the methodology applied with respect to sampling, trace analysis, and evaluation and exemplifies the capabilities on the basis of selected data obtained.

9980 (CONF-8512105—, pp 19-22) **Transport and balance of heavy metals in the lower courses of the large rivers.** Fanger, H.U. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

In tidal rivers, temporal variabilities of currents with flow reversal and slack water periods, erosion and settling, salinity and biotic interactions, considerably complicate the quantitative treatment of transport processes. As a contribution to the potential solution of the problem, at GKSS a concept and methodology for systematic investigations of suspendend-matter and heavy-metal transport have been developed, which combines hydrographic measurements, trace-element analyses, and numerical modelling. In this paper, the techniques are briefly described and some of the results obtained so far are given for demonstration.

9981 (CONF-8512105—, pp 23-24) **Distribution pathways and fates of heavy metals in marine ecosystems.** Mart, L.; Nuernberg, H.W. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Advances in the ultratrace analysis of heavy metals are outlined. Typical surface water levels of trace metals as well as their deep water profiles are referred to, in order to describe the distribution paths. It could be noted that trace metal levels are by orders of magnitude lower than still presumed few years ago.

9982 **(CORR—86-00385) Verification and sensitivity of the calculational methods used in the PATHRAE code to predict subsurface contaminant transport for risk assessments of SRP waste sites.** Fjeld, R.A.; Elzerman, A.W.; Overcamp, T.J.; Giannopoulos, N.; Crider, S.; Sill, B.L. (Clemson Univ., SC (USA)). Oct 1986. Contract AC09-76SR00001. 154p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE87003102.

Presented in this report are an independent verification of the subsurface contaminant transport calculations contained in the code and an assessment of the sensitivity of predicted contaminant concentrations to uncertainties in transport parameters. The subsurface transport approximation incorporated in the PATHRAE risk assessment code was compared with alternate two-dimensional and three-dimensional approximations and with the EPA VHS model. Agreement between the PATHRAE approximation and the alternate two-dimensional approximation was good. Due to its neglect of vertical dispersion, the PATHRAE model predicted higher groundwater (undiluted) concentrations than the three-dimensional approximation and, for EPA parameters, the VHS model. The use of a value of zero for horizontal dispersivity, as specified for 1 m and 100 m wells in SPR waste site analyses, was found to add an additional degree of conservatism to PATHRAE estimates of groundwater concentration, yielding levels that were more than three orders of magnitude higher than those of the three-dimensional model for a 100 m well. Implementation of the transport approximation in the PATHRAE code was verified by comparing code generated concentrations with those of an independent calculation for wide ranges of the input parameters. Agreement between PATHRAE and the independent calculations was excellent.

9983 **(DOE/EV/70134—T10) [Distribution and fate of biogenic and petroleum derived substances in marine sediments]: Final report.** Kaplan, I.R. (California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics). [1986]. Contract AS03-76EV70134. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003104.

The studies were aimed at a better understanding of the processes occurring at the sediment-water interface, the carbon budget in the ocean, the flux of the light elements, and the diagenetic changes of the sedimentary components. Recent research focused on environmental problems relating to anthropogenic pollution of the southern California Bight as a result of petroleum exploration and production and shelf edge exchange processes and transport of carbon in the Atlantic shelf, slope and the rise. Inorganic geochemical, organic geochemical and stable isotopic mass spectrometer studies conducted to achieve the above-mentioned goals have resulted in the development of several techniques for the study of e.g., trace, elements by atomic absorption spectroscopy; gases through separation on vacuum lines and identification by gas chromatography; stable isotopes by use of dual-collecting mass spectrometers on specially-prepared environmental samples and characterization of several organic compounds by gas chromatography and mass spectrometry after optimized sample preparations.

9984 **(DPST—85-404) M-Area seepage basin closure, Lost Lake wetlands, and endangered species review.** Mackey, H.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Sep 1985. Contract AC09-76SR00001. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002661.

The Savannah River Plant (SRP) M-Area settling basin has received process effluents from the fuel and target fabrication facilities since 1958. Waste effluents have contained metal degreasers, acids, caustics, and heavy metals. Use of the settling basin stopped on July 19, 1985, and a closure plan was developed. As part of the closure plan, the influent to the M-Area settling basin will be stopped and the majority of the water remaining in the basin will be pumped, following treatment if necessary, to a natural seepage area and to a shallow depression (Carolina Bay), known as Lost Lake south of the basin. The contaminated soils in the seepage area and in Lost Lake would be excavated and transferred to the basin. The surface of the seepage area and Lost Lake will be graded and revegetated with either pines or hardwoods following removal of the contaminated soil or they will be allowed to revert to a natural wetlands similar to other Carolina Bays on the SRP. Neither Lost Lake nor the pine forests immediately surrounding it provide suitable habitat for endangered species.

9985 **(NP—7750798) International Commission for Water Pollution Control of the Rhine River. Annual report 1984.** (Internationale Kommission zum Schutze des Rheins gegen Verunreinigung, Koblenz (Germany, F.R.)). 1985. 118p. (In German and French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750798.

On the whole the water quality of the Rhine river has been considerably improved during the past decade. This evident improvement is chiefly attributed to water pollution control consisting in measures provided for by the riverains. Apart from preserving the quality achieved and looking for still further measures to check pollution the present aim consists in providing adequate measures which even in case of a sudden economic growth will succeed in reducing pollution even more. This in Wind the commission has kept on developing the 'chemistry convention' and ratified its standards for polychlorinated biphenyl (PCB), polycyclic aromatic hydrocarbons (PAH) and benzidine. Analyses for nickel, copper, zinc, lead, mercury and other substances were continued. Improvements of the water quality do manifest themselves only slowly in the sediments of the Rhine. The commission is making efforts to come to grips with the chemical pollution of sediments. Analyses of sedimentary pollution are given priority to. The study points out the fact that many of the pollutants which at present cannot be detected any more in the water appear to be contained in much higher concentrations in the sediments.

9986 **(UCID—20917) Environmental protection investigations and corrections series: Distribution of VOCs [volatile organic compounds] in round water in the southeast area of LLNL and vicinity.** Dresen, M.D.; Nichols, E.M. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1986. Contract W-7405-ENG-48. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003595.

Lawrence Livermore National Laboratory (LLNL) drilled 22 soil borings and 25 monitor wells to investigate the distribution of volatile organic compounds (VOCs) in ground water in the southeast area of LLNL and vicinity. Samples of saturated and unsaturated soil and ground water were collected and analyzed for VOCs. We have used these geologic and chemical data to define the vertical and horizontal distribution of VOCs in ground water.

Ground water flow and VOC migration appear to be generally southward in the study area and are integrally related to the subsurface geology. The relatively shallow depth of the low-permeability, low piezometric head, lower member of the Livermore Formation in the study area has induced a significant downward gradient, apparently causing ground water and VOCs to migrate southward in permeable sediments near the contact between the upper and lower members of the Livermore Formation. Trichloroethylene (TCE), tetrachloroethylene (PCE), 1,1-dichloroethylene (1,1-DCE), and carbon tetrachloride (CCl_4) have been detected in ground water in the study area in concentrations exceeding action levels recommended by the California Department of Health Services (DOHS). TCE is the predominant VOC in the study area. Ground water chemistry and site history data indicate that there are three main sources of VOCs in ground water in the study area and vicinity. A suspected VOC source just south of Building 518 is characterized by TCE with low concentrations of 1,1-DCE, PCE, and CCl_4. A second VOC source in the Building 612 yard/Building 514 area is characterized by higher concentrations of 1,1-DCE and CCl_4 relative to TCE. A third source in the Taxi Strip/Old Salvage Yard area north of the study area is characterized by TCE with or without very low concentrations of CCl_4.

9987 (CE-Trans—8239) **Effect of thermal pollution on the development of grass and silver carp embryos.** Jiang, L.F.; Cao, C.H. Translated from *Environmental Sciences in China ;* 4: No. 6, vp(Dec 1984). 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900069.

The study of the effect of thermal pollution on the development of fish embryos has practical significances on the protection of water, development of fisheries, and setting of standards for the fishery reservoirs. In recent years, due to the rapid development of thermal and nuclear generated Electricity Industries, thermal pollution of effluent water has attracted extensive attention both in this Country and abroad. In order to eliminate the obstacles to the propagation of fishes, this article introduces the effect of thermal pollution (including the pollution due to the presence of copper, cadmium, and lead) on the development of Grass Carp and Silver Carp embryos, and at the same time employing histological methods to observe the abnormal changes, and the delayed development of the fish embryos.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 8923, 8937, 8999, 9878, 9920, 9921, 9922, 9923, 9937, 9938, 9944

9988 (CNEA-NT—10/85) **Transfer of nuclides from the water phase to the sediments during normal and extraordinary hydrological cycles. Parana de las Palmas River.** (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Direccion de Radioisotopos y Radiaciones). Jul 1985. 63p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700272.

Work made in collaboration with IAEA (Contract No. 3318/R1/RB), participating CNEA, Inst. Nac. Cien. y Tecnicas Hidricas (INCYTH) and Inst. Nac. de Geocronologia y Geologia Isotopica (INGEIS). Scientific researcher-Head: H.R. Gomez.

Atucha I and Atucha II nuclear power plants are located on the right margin of the Parana de las Palmas River. This river belongs to the Cuenca del Plata, whose 1982-1983 hydrologic cycle registered the greatest freshets of the century. Works and studies previously fixed had to be altered and investigations were adapted to the possibilities and the particular hydric conditions verified. Considerations on the transfer of nuclides between water and sediments are presented. The floods reduce the water-sediments contact time on the bed of the river. In outer areas, the waters labelled by the nuclear power plant effluent discharge favor the infiltration in alluvial soils, as well as the exchange with the sediments. The investigations carried out for the phase near to the discharge of liquid effluents (related to the critical group) made possible to prove the characteristics of the path of the liquid wastes released, the distribution coefficient and the fixation or penetrability of some nuclides in soils of the floody valley. In this manner, a balance of radioactive nuclides incorporated to soils and sediments from the neighbourhood of Atucha and the water-course of Parana de las Palmas river is obtained. The presence of ^{60}Co and ^{137}Cs in the floody soils on the right margin of this river was detected and measured during the greatest flood of the century. On the other hand, ^{144}Ce, ^{51}Cr, ^{106}Ru and ^{90}Sr have not been detected. The detection of artificial radioisotopes turns out to be impossible in normal hydrological years, even in the surroundings of the nuclear power plant or the critical group (from the point of view of the surface waters, The Fishing Club, 3 km down stream).

9989 (DEMO—84/5) **Concentrations of ^{222}Rn in well and tap waters of North-Eastern Attiki.** Kritidis, P.; Angelou, P. (Democritos Nuclear Research Center, Athens (Greece)). Jul 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900233.

An alpha-scintillation system for determination of low ^{222}Rn concentrations in water is described. The use of vacuum sampling, the avoidance of sample transfer and the corrections applied result in low systematical errors. The method has been used for a preliminary investigation of ^{222}Rn concentrations in well waters of North-Eastern Attiki, where values between 4 and 345 pCi have been observed. The additional annual effective dose equivalent due to the systematic domestic use of water with the highest radon concentration measured is estimated not to exceed 5 mrem.

9990 (EIR—599) **BIOMOVS test scenario model comparison using BIOPATH.** Grogan, H.A.; Van Dorp, F. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland); Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jul 1986. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700218.

This report presents the results of the irrigation test scenario, presented in the BIOMOVS intercomparison study, calculated by the computer code BIOPATH. This scenario defines a constant release of Tc-99 and Np-237 into groundwater that is used for irrigation. The system of compartments used to model the biosphere is based upon an area in northern Switzerland and is essentially the same as that used in Projekt Gewaehr to assess the radiological impact of a high level waste repository. Two separate irrigation methods are considered, namely ditch and overhead irrigation. Their influence on the resultant activities calculated in the groundwater, soil and different food products, as a function of time, is evaluated. The sensitivity of the model to parameter variations is analysed which allows a deeper understanding of the model chain. These results are assessed subjectively in a first effort to realistically quantify the uncertainty associated with each calculated activity.

9991 (INIS-mf—10509) **Speciation and bioavailability of americium-241 in the fresh water environment.** Bierkens, J. (Universitaire Instelling Antwerpen (Belgium)). 1986. 300p. (In Dutch). NTIS (US Sales Only), PC A13/MF A01. File Number DE87700270.

Due to its anthropogenic origin, the transuranic americium 241 confronts physiologists with the intriguing question, which mechanisms are involved in the incorporation or elimination of such artificial elements in biological cycles. The investigations on the speciation and bioavailability of ^{241}Am in the freshwater environment aim to establish a relation between the behavior of ^{241}Am in freshwater ecosystems and its availability for biota. In the limnic environment, most often characterized by a high organic load and a low conductivity, the effect of complexation of ^{241}Am with humic acids and competition with trivalent cations such as A1 and Fe, were proven to be significant on the speciation of ^{241}Am. Based on the registration of the ^{241}Am uptake by a large number of freshwater organisms, the crayfish Astacus leptodactylus Eschscholtz was chosen to study the whole-body uptake of ^{241}Am, its corresponding organ distribution and its retention in the animal. The share of external fixation and ingestion in the global uptake, and the effect of speciation on it, were studied more carefully. Other aspects in this physiological part were: the kinetics of ^{241}Am in the hemolymph and the hepatopancreas, and its subcellular distribution in the digestive gland. Finally, by comparing the physiology of ^{241}Am with some other metals (^{240}Pu, ^{64}Cu, ^{198}Au) with analogous or contradictional properties, we tried to find out whether the behavior of

^{241}Am in organisms can be explained from its chemical characteristics. 222 refs.

9992 (NIRS-RSD—66, pp 15-16) **Strontium-90 and cesium-137 in service water (from July 1983 to December 1983). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Service water, 100 l each, was collected at an intake of a water treatment plant and at a tap after water was left running for five minutes. Water, to which the carriers of strontium and cesium were added immediately after sampling, was vigorously stirred and filtered. The sample was passed through a cation exchange column. Strontium and cesium were eluted with hydrochloric acid from the cation exchange column. The eluate was used for radiochemical analysis. The chemical separation of strontium-90 and cesium-137 was carried out, and the chemical yields were determined. The precipitates were counted for the activity using low background beta counters normally for 60 min. The net sample counting rate was corrected to obtain the radioactivity per sample aliquot, and the concentrations of these nuclides in the original samples were calculated. The data at 20 sampling locations in Japan from July to December, 1983, on source water and tap water are reported.

9993 (NIRS-RSD—66, pp 17) **Strontium-90 and cesium-137 in freshwater (from September 1983 to December 1983). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Fresh water, 100 l each, was collected, and to which the carriers of strontium and cesium were added immediately after the sampling. The sample was vigorously stirred and filtered, and passed through a cation exchange column. Strontium and cesium were eluted with hydrochloric acid from the cation exchange column. The eluate was used for radiochemical analysis. The chemical separation of strontium-90 and cesium-137 was carried out, and the chemical yields were determined. The precipitates were counted for the activity using low background beta counters normally for 60 min. The net sample counting rate was corrected for the counter efficiency, recovery, self-absorption and decay, to obtain the radioactivity per sample aliquot, and the concentrations of these nuclides in the original samples were calculated. The data at six sampling locations in Japan from September to December, 1983, on fresh water are reported.

9994 (NIRS-RSD—66, pp 21-22) **Strontium-90 and cesium-137 in sea water (from July 1983 to September 1983). Environmental and dietary materials.** Sep 1983. NTIS (US Sales Only), PC A03/MF A01. File Number DE87780032.

In Radioactivity survey data in Japan.

Results are presented for the determination of strontium-90 and cesium-137 in coastal sea water of 11 fixed sampling points all over Japan from Hokkaido to Okinawa where the effect of terrestrial fresh water from rivers or atmospheric precipitation was expected to be ignorable. Sampling was carried out from July to August, 1983. After sampling with special care for prevention of contamination, water samples were acidified immediately to a pH lower than 3 by adding hydrochloric acid to prevent sample deterioration. Radiochemical pretreatment for the separation and purification of strontium-90 or cesium-137 was carried out, and radioactivity of each radionuclide was determined with a low background beta counter normally for 60 minutes. As for strontium-90 contents, they were ranged from 0.07 +- 0.009 pCi/l (Ise Bay, Aichi Prefecture) to 0.12 +- 0.012 pCi/l (Osaka Port, Osaka Prefecture) and the average value was 0.09 pCi/l. As for cesium-137 contents, they were ranged from 0.05 +- 0.010 pCi/l (Ise Bay, Aichi Prefecture and Osaka Port) to 0.14 +- 0.012 pCi/l (Yamaguchi Bay, Yamaguchi Prefecture and Kinnakagusuku Bay, Okinawa Prefecture) and the average value was 0.010 pCi/l. Seasonal variance or differences among sampling points were not clarified both for strontium. It was speculated that the determined values were normal in general as the concentration of these radionuclides in coastal sea water in Japan.

9995 (NIRS-RSD—68, pp 14-16) **Strontium-90 and cesium-137 in service water from December 1983 to July 1984. Environmental and dietary materials.** Mar 1984. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in service water measured throughout Japan from December 1983 to July 1984 are given in pCi/l. Sampling points are total of 33 from Wakkanai (Hokkaido) to Naha (Okinawa). Collection and pretreatment of samples, preparation of samples for analysis, separation of strontium-90 and cesium-137, determination of stable strontium, calcium and potassium, and counting are described. Service water, 100 l each, was collected at an intake of the water-treatment plant and at the tap. The sample was passed through a cation exchange column. After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 minutes.

9996 (NIRS-RSD—68, pp 17) **Strontium-90 and cesium-137 in freshwater from May 1984. Environmental and dietary materials.** Mar 1984. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780033.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in freshwater measured in May 1984 are given in pCi/l. The sampling point is 1, Kasumigaura-Lake (Ibaraki). Collection and pretreatment of samples, preparation of samples for analysis, separation of strontium-90 and cesium-137, determination of stable strontium, calcium and potassium, and counting are described. The sample was passed through a cation exchange column. After the radiochemical separation, the mounted precipitates were counted for activity using low background beta counters normally for 60 minutes. (Mori, K.).

9997 (ORNL/M—174) **Environmental surveillance data report for the third quarter of 1986.** (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003309.

During the third quarter of 1986, over 1900 samples which represent over 6700 analyses and measurements were collected by the Department of Environmental Management. Eleven real-time air monitoring stations which telemeter 10-minute averaged readings on radiation levels and total rainfall around ORNL also reported data. Three real-time water monitoring stations that transmit flow and water quality data were put into operation. The ^{131}I concentrations in air and milk which were significantly elevated during the second quarter by the Chernobyl nuclear incident have returnted to normal. When compared to the second quarter, no significant differences were observed in the average concentrations of ^{90}Sr in milk and air in the immediate Oak Ridge and remote areas. Greater than 80% of the tritium discharges over White Oak Dam could be attributed to the releases into Melton Branch. Tritium discharges in this area are believed to be due primarily to releases from Solid Waste Storage Area 5. Groundwater samples from four deep wells around the ORNL surface impoundment areas 3524, 3539-40, and 7900 were also collected during this quarter. The sampling is required by the Tennessee Department of Health and Environment under interim status provisions for RCRA facilities. Further sampling of these sites will be determined based on an evaluation of the first year data. The groundwater wells in SWSAs 4, 5, and 6, and the pits and trenches areas were also analyzed for radionuclides. Bluegill were collected from Clinch River Miles 5.0, 20.8, and 25 and analyzed for radionuclides. In addition, fish from CRM 20.8 and 25.0 were analyzed for mercury and PCBs. The highest concentrations of constituents were in fish collected from CRM 20.8 which is at ORNL's discharge point. The concentrations of mercury and PCBs in fish were lower than the limits set by the Food and Drug Administration. 21 figs., 31 tabs.

9998 (YJT—86-06) **Water run of the Lavia test borehole - an interpretation of the test data.** Ylinen, A. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Apr 1986. 94p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750409.

In 1984 a 1001 metres deep testhole was drilled in Lavia, Western Finland, for developing and testing equipments and methods to investigate the properties of rock for its suitability as a site for a nuclear waste repository. During the same year, constant head injection tests were performed in the hole. The method was two-packer test with 30 metres long test interval. Totally 30, mainly 2 hours' 2000kPa, tests were made in the subsequent depths. The data, pressure, flow rate and temperature, during the injection and fall-off phases, were stored in the numerical form in micro-computer diskettes. The aim of this study is to make an interpretation of the test data for getting knowledge about the rock ability of conducting water. The traditional homogeneous Horner and reciprocal flow interpretations are made and the water conducting parametres are estimated. Also a new method of taking into account the differences in fracture types (fillings, roughness, shape, etc.) and the causing different transmissivity, is derived and used for the fracture interpretation. As a result, a dense spectrum for flow parametres is obtained from the same data. Finally, the relevance of different parametres and their suitability for testing and modelling the flow in the rock is evaluated, and new schemes for further investigation are proposed.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 9136, 9985

9999 **(DPST—85-790) Macroinvertebrates of Par Pond and Pond B: Final report, January 1984-June 1985.** Kondratieff, B.C.; Chimney, M.J.; Painter, W.B. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Aug 1985. Contract AC09-76SR00001. 199p. (ECS-SR—21). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87002824.

This document reports on the Par Pond and Pond B macroinvertebrate sampling program from January 1984 through June 1985. It includes data on quantitative and qualitative benthic sampling, quantitative meroplankton sampling and quarterly diel sample. The basic objectives were to: (1) characterize the benthic and meroplankton macroinvertebrate communities of Par Pond and Pond B, with respect to taxonomic composition and diversity, density and relative abundance of functional feeding groups; (2) assess the impact of thermal discharges on the macroinvertebrate community of Par Pond; (3) assess the impact and significance of entrainment losses of macroinvertebrate meroplankton from Par Pond; and (4) compare Par Pond macroninvertebrate communities with those in Pond B.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 9041, 9984

10000 **(EPRI-EA—4838) Sport fishery potential of power plant cooling ponds: Final report.** Heidinger, R.C.; Lewis, W.M. (Southern Illinois Univ., Carbondale (USA). Cooperative Fisheries Research Lab.). Oct 1986. 164p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920116.

This research was undertaken to determine if cooling ponds could serve as habitat for several coolwater fish species and also to evaluate the potential use of cooling ponds as nursery areas for receiving waters. The work was conducted on two cooling ponds in northern Illinois. Walleye (Stizostedion vitreum), muskellunge (Esox masquinongy), striped bass (Morone saxatilis) fingerlings, and adult threadfin shad (Dorosoma petenense) were stocked into both cooling ponds. The hybrids between the striped bass and white bass (M. chrysops) had been previously stocked into Collins Pond. Smallmouth bass (Micropterus dolomieui) fingerlings and larval striped bass and walleye were stocked in Dresden Pond. Several sampling techniques including seining, electrofishing, and rotenoning were used to monitor growth and survival of stocked species. In addition, escapement of stocked and indigenous species was monitored at the Dresden Pond spillway. Walleye, muskellunge, striped bass and hybrid striped bass exhibited excellent growth in Collins Pond as did smallmouth bass in Dresden Pond. One of the primary differences between an open system (such as Dresden Pond) and a closed system (such as Collins Pond) is the potential that the open system has to serve as a fish nursery area for receiving waters. The stocking of "coolwater" species in a closed type system such as Collins Pond is an effective way to control and maintain selected sport species. Dresden Pond was not open to public fishing during this study, but Collins Pond developed an excellent sport fishery as a result of these stockings.

10001 **(TVA/ONRED/WRF—86/5a) Aquatic environmental conditions in Chickamauga Reservoir during operation of Sequoyah Nuclear Plant: Fifth annual report (1985).** Beard, L.M.; Bruggink, D.J.; Buchanan, J.P.; Buckingham, R.A.; Dycus, D.L.; Mulkey, C.E.; Smith, A.O.; Swor, C.T.; Tomljanovich, D.A.; Wade, D.C. (Tennessee Valley Authority, Knoxville (USA). Div. of Air and Water Resources). Aug 1986. 309p. NTIS, PC A14/MF A01. File Number DE87900338.

TVA is required by its National Pollutant Discharge Elimination System (NPDES) Permit for Sequoyah Nuclear Plant (SQN) to conduct and report annually on operational nonradiological monitoring to evaluate potential effects of SQN on Chickamauga Reservoir. Because few changes were identified through 1984, the following changes were recommended in June 1985: (1) terminate studies on benthic macroinvertebrates, mollusk bioaccumulation, fish impingement, fish gill netting, fish creel surveys, and water quality at the plant intake and discharge; (2) continue studies on plankton and larval fish with specific changes; and (3) continue cove rotenone studies without change. These recommendations were instituted in July 1985 following approval from the Environmental Protection Agency (EPA). This report evaluates 1985 results for the continued portions and, briefly, for the discontinued portions conducted prior to EPA's approval. Evaluation of water quality data showed that during low flows SQN altered the distribution of DO in the water column at and downstream of the diffusers. Studies to define the extent and duration of the DO alteration will be conducted during spring and summer when SQN resumes operation.

10002 **(TVA/ONRED/WRF—86/5b) Aquatic environmental conditions in Chickamauga Reservoir during operation of Sequoyah Nuclear Plant: Fifth annual report (1985), Appendices.** Beard, L.M.; Bruggink, D.J.; Buchanan, J.P.; Buckingham, R.A.; Dycus, D.L.; Mulkey, C.E.; Smith, A.O.; Swor, C.T.; Tomljanovich, D.A.; Wade, D.C. (Tennessee Valley Authority, Knoxville (USA). Div. of Air and Water Resources). Aug 1986. 187p. NTIS, PC A09/MF A01. File Number DE87900337.

These 23 appendices present data on water chemistry, phytoplankton, chlorophyll, zooplankton, benthos, and fishes from Chickamauga Reservoir in the vicinity of Sequoyah Nuclear Plant. (ACR)

5206 Regulations

10003 **(UCID—20720-Pt.2) US Department of Energy Comprehensive Environmental Response Compensation and Liability Act Program, DOE Order 5480.14: Lawrence Livermore National Laboratory Phase I, Installation assessment: Part II, Livermore site.** Lindeken, C.L.; Loftis, J.A.; Ragaini, R.C. (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 66p. NTIS MF A01; 2; GPO Dep. File Number DE87002741.

The identification and location of those hazardous waste sites within LLNL that may pose an undue risk to health, safety, and the environment from the migration of hazardous substances from these sites are documented. The scope of this Phase I Assessment is limited to the identification and evaluation of four hazardous waste locations at LLNL's Livermore Site. These evaluations have been performed in accordance with the guidance provided in DOE Order No. 5480.14. This report includes the results of the investigation conducted through June, 1986.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 9934

5301 Social And Economic Studies

10004 (DOE/NV/10270—3) **Socioeconomic profile of Nye County, Nevada: Community services inventory.** (Science Applications International Corp., Las Vegas, NV (USA)). Sep 1986. Contract AC08-83NV10270. 75p. (SAIC—85/8000). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002864.

The Nevada Nuclear Waste Storage Investigations Project is preparing socioeconomic profiles of Nye County, Nevada, and communities in Nye County that could be affected by siting, construction, operation, and decommissioning of a high-level nuclear waste repository at Yucca Mountain, located in Nye County. These profiles serve as a data base for evaluating local community service impacts; store existing socioeconomic data in a uniform, readily accessible format; identify the need for additional data; and assist in developing a plan for monitoring and mitigating any significant adverse impacts that may be associated with site characterization and potential repository development. This element of the socioeconomic profiles contains an inventory of community services provided by local, county, and state agencies and volunteer organizations to residents of Amargosa Valley, Beatty, and Pahrump. Services inventoried for each community include housing, growth management, general government, education, police protection, transportation networks, public clinics, private health personnel, parks and recreation, social services, libraries, ambulances, electric power, heating fuel, water, sewers and wastewater treatment, solid waste, and fire protection. The report includes a summary overview of service providers in Nye County, discussions of services provided to residents of the three communities, and summary tables. Data presented in this profile were collected through early 1985. Data collection efforts are ongoing and this profile will be updated periodically.

10005 (DOE/NV/10270—4) **Socioeconomic profile of Clark County, Nevada: Community services inventory.** (Science Applications International Corp., Las Vegas, NV (USA)). Sep 1986. Contract AC08-83NV10270. 126p. (SAIC—85/8001). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87002866.

The Nevada Nuclear Waste Storage Investigations Project is preparing socioeconomic profiles of Clark County, Nevada, and communities in Clark County that could be affected by siting, construction, operation, and decommissioning of a high-level nuclear waste repository at Yucca Mountain, located in Nye County. These profiles serve as a data base for evaluating local community service impacts; store existing socioeconomic data in a uniform, readily accessible format; identify the need for additional data; and assist in developing a plan for monitoring and mitigating any significant adverse impacts that may be associated with site characterization and potential repository development. This element of the socioeconomic profiles contains an inventory of community services provided by local, county, and state agencies and volunteer organizations to residents of Las Vegas, North Las Vegas, Henderson, Boulder City, Indian Springs, and unincorporated areas of the county. Services inventoried include housing, growth management, general government, education, police protection, transportation networks, public clinics, private health personnel, parks and recreation, social services, libraries, ambulances, electric power, natural gas, water, sewers and wastewater treatment, solid waste, and fire protection. The report includes a summary overview of service providers in Clark County, discussions of the services provided to residents of communities in Clark County that may be affected by Project activities, and a description of service providers whose service areas are not limited to the incorporated areas of Clark County. Data presented in this profile were collected through March of 1985. Data collection efforts are ongoing and this profile will be updated periodically.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 9042

10006 (DOE/EA—0305) **Environmental assessment: Proposed contract with Southern California Edison.** (USDOE Bonneville Power Administration, Portland, OR. Office of Power and Resources Management). May 1986. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002665.

This Environmental Assessment (EA) describes the environmental impacts of the proposed power sale and capacity/energy exchange between BPA and Edison. It also analyzes the cumulative environmental impacts of making other firm extraregional firm surplus sales of this nature, since there is a possibility of such sales in the near-future.

10007 (IIUG/dp—85-3) **Research and development incentives for pollution control technologies.** Hartje, V.J.; Lurie, R.L. (Wissenschaftszentrum Berlin (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). 1985. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750799.

This paper examines the r+d incentives for pollution control innovations as they exist within the current regulatory system. It distinguishes between add-on, end-of-pipe abatement technologies and 'clean' or low-emission production technologies. The authors find considerable r + d incentives but they tend to favour end-of-pipe abatement technologies over low-emission technologies. This direction is due to the relative market size of both technologies, the adoption rules of the users, a bias in the regulatory system and technology specific factors. The development of low emission technologies is quite often a byproduct in the search for energy and material-saving innovations. For the end-of-pipe technologies, the incentives work mostly in favour of cost savings instead of emission-reducing innovations because of different marketing risks. Removing or lowering the adoption barriers encountered here is probably the most promising path for policy change.

10008 (TVA/ONRED/AWR—85/9) **Integrated environmental assessment of biomass for energy.** Bohac, C.E. (Tennessee Valley Authority, Chattanooga (USA). Office of Natural Resources and Economic Development). Apr 1986. 236p. NTIS, PC A11/MF A01. File Number DE87900339.

This report summarizes the major environmental issues of energy development from biomass materials within the Tennessee Valley region. The findings are intended to warn of possible environmental and economic consequences which could result from accelerated use of biomass for energy in the region. The principle areas of investigation include the combustion of alcohol fuels and wood, the impacts of additional harvesting of wood and agricultural crops for energy, and the impact of processes to convert biomass into liquid and gaseous fuels. Impacts are identified and strategies for reducing the magnitude of adverse impacts are evaluated for three levels of biomass for energy development. The timeframe for the investigation is up to the year 2000. 62 refs., 36 figs., 18 tabs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

10009 (PNL-SA—14094) **Extended workdays: Effects of 8-hour and 12-hour rotating shift schedules on test performance, subjective alertness, sleep patterns, and psychological variables.** Rosa, R.R.; Colligan, M.J.; Lewis, P. (Pacific Northwest Lab., Richland, WA (USA); National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Biomedical and Behavioral Science). Jun 1986. Contract AC06-76RL01830. 12p. (CONF-8609105—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003173.

From Annual meeting of the Human Factors Society; Dayton, OH, USA (30 Sep 1986).

A newly instituted 3 to 4 day/12-hr rotating shift schedule was compared to the previous 5 to 7 day/8-hr schedule using standard laboratory-type measures of performance and alertness, and a questionnaire on sleep patterns and other personal habits. After seven months adaptation to the new schedule, a preliminary analysis indicates that there were some decrements in alertness, reductions in sleep, and disruptions of other personal activities during 12-hr workdays. Gastro-intestinal state improved during night shift, however, and increases in self-reported stress were reduced by the shortened workweek. These results are discussed in terms of tradeoffs between longer workdays and shorter workweeks. It is emphasized that at this time no determination can be made of the extent of risk associated with these changes in alertness.

5502 Biochemistry

REFER ALSO TO CITATION(S) 9044, 9536

10010 (ANL-BIM—84-1) Operation of the ISO-DALT system: Seventh edition. Tollaksen, S.L.; Anderson, N.L.; Anderson, N.G. (Argonne National Lab., IL (USA)). May 1984. Contract W-31-109-ENG-38. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003617.

The ISO-DALT system of two-dimensional electrophoresis was developed as a series of modifications of the original technique of O'Farrell. We have written a series of recipes and more detailed laboratory procedures that incorporate refinements and "tricks of the trade" as they have developed during our use of the system. The present collection is the seventh version in this series and represents the state of art as of May 1984. The seventh edition has been prepared to incorporate the changes that we have found helpful, as well as to add a few new sections such as silver staining, transfer gels, ACIDOs, and BASOs. Although these directions are specific for our laboratory, we hope that they will be helpful in other laboratories as well. Although some disagreement still exists, we recommend that gel patterns be oriented with acid isoelectric points (pIs) to the left and high sodium dodecyl sulfate (SDS) molecular weights at the top. This results in a system of pI and molecular weight values that run according to the Cartesian convention and facilitates the use of the charge and molecular weight standards described herein. 67 refs., 14 figs.

10011 (CONF-8606150—2) Synthesis, purification and properties of a new class of pteridine derivatives. Ferre, J.; Yim, J.J.; Pfleiderer, W.; Jacobson, K.B. (Oak Ridge National Lab., TN (USA); Valencia Univ. (Spain). Dept. of Genetics; Seoul National Univ. (Republic of Korea). Dept. of Microbiology; Konstanz Univ. (Germany, F.R.). Dept. of Chemistry). 1986. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002626.

From 8. international symposium on pteridines and folic acid derivatives; Montreal, Canada (14 Jun 1986).

A mixture of dihydroneopterin triphosphate (H_3NTP) was boiled with Tris-HCl at pH 8.5 and several compounds with unique uv and fluorescent properties were produced, one of them thought to be 6-pyruvoyl-H_4-pterin (PH_4P). This paper presents evidence that the pteridine derivatives represent a new group with unique structural characteristics and that, although none of them are PH_4P, the latter is also a precursor for their chemical synthesis. 4 refs., 2 figs.

10012 (DOE/ER/13339—2) Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1985-December 1986. Blake, R. II. (Meharry Medical Coll., Nashville (USA). Dept. of Biochemistry). Dec 1986. Contract FG05-85ER13339. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003320.

The kinetic rate law constant for the one electron reduction of rusticyanin by ferrous ion was determined. Three stable forms of ferrous ion predominate at the pH growth range of the bacterium in the presence of the sulfate/bisulfate conjugate pair: aqueous hexaquo ferrous ion, a soluble neutral ferrous-sulfate complex, and a positively charged ferrous-bisulfate complex. All three forms of ferrous ion reduce the rusticyanin with kinetic behavior consistent with a reversible second-order reaction, with no evidence for precursor complex formation. The apparent second-order rate constants for reduction of the rusticyanin are in the order ($FeSO_4$) > $(FeHSO_4)^{1+}$ much greater than Fe^{2+}. Since the predominant form of ferrous ion at the optimal pH (2.0) for growth of the organism is the ferrous-sulfate complex, one may conclude that this complex is the principal reductant of rusticyanin.

10013 (DOE/ER/13525—T1) The bioenergetics of salt tolerance: Final report [Irvine Laboratory]. Lanyi, J.K. (California Univ., Irvine (USA). Dept. of Physiology and Biophysics). 28 Oct 1986. Contract FG03-86ER13525. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002809.

We have studied the physiology and molecular mechanism of light-driven chloride transport by halorhodopsin in the halobacteria, and initiated work in the ion-transport ATPase of halobacteria and the respiration-linked sodium transport system of the halotolerant bacterium, Bal. The results have provided insights into the role and functioning of ionic pumps. Chloride transport was shownto be an integral component of the overall ion circulation in halobacterial cells, one which maintains internal salt concentration and therefore cellular volume. How halorhodopsin functions; its photointermediates, the nature of chloride-binding sites, the role of the deprotonation of the retinal Schiff-base, and how removal of most of the arginine residues affects chloride-binding were investigated. Methods were adapted and developed for the study of membrane-bound halobacterial ATPase, its solubilization and partial purification. It was shown that in the salt-tolerant pseudomonad, Bal, the sodium-sensitive step in the respiratory chain is at the reduction of the semiquinone to quinol, as in another unrelated, but also salt-tolerant, marine microorganism. 10 refs., 1 fig.

10014 (DOE/ER/60069—T4) DNA damage in human cells. Progress report, 1984. Loeb, L.A. (Washington Univ., Seattle (USA). School of Medicine). Aug 1986. Contract AT06-82ER60069. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86015601.

This progress report describes studies centering on the relationship between DNA damage and mutagenesis. The mutagenic potential of apurinic sites was documented in a variety of systems. Sensitive biochemical and immunological assays were developed for quantitating apurinic sites in cellular DNA. The enhancement of depurination by metal ions was further characterized. Deoxynucleoside triphosphate pools are altered as a result of treating both bacteria and animal cells with DNA damaging agents. A new method for site-specific mutation was designed and this method was used to prepare DNA templates containing noncomplementary nucleotides and nucleotide analogues at designated positions in biologically active DNA. Double stranded DNA templates in which 1% of the base pairs are noncomplementary were prepared. Recombinant DNA techniques were used to measure nucleotide substitution in human mitochondrial DNA.

10015 (DOE/EV/70190—T2) Endonucleases involved in repair and recombination of DNA: Comprehensive report for the period April 1, 1970-November 30, 1985. Linn, S.M. (California Univ., Berkeley (USA). Dept. of Biochemistry). 1985. Contract AS03-76EV70190. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003190.

DNases appear to be required to reproduce and maintain the integrity of the DNA. In this regard they operate in the capacities of salvage and scavenger enzymes for reutilization of DNA monomeric material, DNA replication, genetic recombination, repair, and protection against information brought in by foreign DNA. Each of these functions is necessary for survival, reproduction and evolution of any living species. The study of DNases has now advanced to the point where we know a great deal about individual enzymes so far as their in vitro activities are concerned. We must now work at identifying in vivo substrates and reaction conditions so as to be sure that we study biologically meaningful reactions. 70 refs.

10016 (Juel-Spez—316, pp 126-130) **Proof for conformational changes of the F_1ATPase from Micrococcus luteus by investigations of the enzyme kinetics and neutron small angle scattering.** Nawroth, T.; Dose, K.; Conrad, H. (Mainz Univ., Germany, F.R. Inst. fuer Biochemie; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Projekt Spallationsneutronenquelle; Kernforschungsanlage Juelich G.m.b.H., Germany, F.R. Inst. fuer Festkoerperforschung). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

10017 (Juel-Spez—316, pp 131-134) **Neutron diffraction at partly deuterated retinal in bacteriorhodopsin.** Seiff, F.; Wallat, I.; Ermann, P.; Heyn, M.P. (Freie Univ. Berlin, Germany, F.R. Abt. fuer Biophysik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

10018 (Juel-Spez—316, pp 135-143) **Structural and functional investigations at the ribosome by means of neutron diffraction.** Nierhaus, K.H.; Voss, H.; Nowotny, V.; May, R. (Max-Planck-Institut fuer Molekulare Genetik, Berlin, Germany, F.R.; Institut Max von Laue - Paul Langevin, 38 - Grenoble, France). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article gives an overview on the information which can be obtained by neutron diffraction at the ribosome. The strategy of the "glassy ribosome" is outlined, by which the conformational changes of some components during ribosome synthesis, the spatial distribution of the ribosomal proteins inside the big subunit and the cartography of the t-RNS bonding can be investigated.

10019 (Juel-Spez—316, pp 144-148) **Neutron diffraction at chromosomes.** Ibel, K. (Osnabrueck Univ., Germany, F.R. Fachbereich Biologie/Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

It is possible to investigate complicated biological structures by neutron diffraction. The present report deals with results of three investigations: 1) Neutron/diffraction at metaphase-chromophores; 2) The comparison of acetylated and deacetylated nuclei; 3) The dissolution and reconstitution of structures of higher order.

10020 (Juel-Spez—316, pp 149-156) **OH---O hydrogen bridges in the hydratation of biological macromolecules: Formation of circular patterns and of flip-flop dynamics.** Saenger, W.; Betzel, C.; Zabel, V.; Brown, G.M.; Hingerty, B.E.; Lesyng, B.; Mason, S.A. (Freie Univ. Berlin, Germany, F.R. Inst. fuer Kristallographie; Oak Ridge National Lab., TN, USA; Warsaw Univ., Poland. Inst. Fizyki Doswiadczalnej; Institut Max von Laue - Paul Langevin, 38 - Grenoble, France). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article deals with hydrogen bridges in the hydratation of biological macromolecules, cyclodextrines, which contain a large number of OH-groups, are suitable model compounds. Investigations have been performed by neutron diffraction.

10021 (Juel-Spez—316, pp 188-198) **Applications of the spin-dependent neutron diffraction in molecular biology.** Stuhrmann, H.B. (Mainz Univ., Germany, F.R. Inst. fuer Physikalische Chemie). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article reports on a first step to the spin-dependent small angle scattering at macromolecules: the influence of the relatively easily arranged polarization of tRNS-bound terbium ions on the small angle scattering was determined via the so-called flipping relation. The importance of the more difficult proton spin polarization for the structural investigations of the ribosomes is discussed.

5503 Cytology

10022 **Structure of plant cell walls. XVIII. An analysis of the extracellular polysaccharides of suspension-cultured sycamore cells.** Stevenson, T.T.; McNeil, M.; Darvill, A.G.; Albersheim, P. (Univ. of Colorado, Boulder). *Plant Physiology;* **80**: No. 4, 1012-1019(Apr 1986). Contract AC02-76ER01426.

The water-soluble polysaccharides (SEPS) secreted into the medium by suspension-cultured sycamore cells were examined to determine whether the polysaccharides were the same as those present in the walls of sycamore cells. The SEPS were made more amenable to fractionation by treatment with a highly purified α-1,4-endopolygalacturonase (EPG). The EPG-treated SEPS were fractionated by anion-exchange and gel-permeation chromatography. The following polysaccharides were found: xyloglucan, arabinoxylan, at least two arabinogalactans, a rhamnogalacturonan-II-like polysaccharide, and a polygalacturonic acid-rich polysaccharide. The oligogalacturonide fragments expected from EPG-digested homogalacturonan were also identified. Evidence was obtained for the presence of a rhamnogalacturonan-I-like polysaccharide. All of the above polysaccharides have been isolated from or are believed to be present in sycamore cell walls. Furthermore, all of the noncellulosic polysaccharides known to be present in sycamore cell-walls appears to be present in the SEPS.

5505 Metabolism

REFER ALSO TO CITATION(S) 10039, 10067, 10078

10023 **Evidence for cyclic electron flow around photosystem II in Chlorella pyrenoidosa.** Falkowski, P.G.; Fujita, Y.; Ley, A.; Mauzerall, D. (Brookhaven National Lab., Upton, NY). *Plant Physiology;* **81**: No. 1, 310-312(May 1986).

Electron flow around photosystem II was investigated in Chlorella pyrenoidosa. Using a bare platinum O_2 electrode, simultaneous measurements were made of steady-state photosynthesis in continuous light, the yield of oxygen (Yo_2) produced by a superimposed saturating xenon flash, and the change in fluorescence yield of a weak flash triggered before and 70 microseconds after the saturating flash. Throughout most of the continuous photosynthesis-irradiance curve, normalized O_2 flash yields (Yo_2/Yo_2/sub max/) and normalized variable fluorescence yields Δomega/Δomega' were linearly correlated with a slope of 1.0. As photosynthetic rates reached light saturation, however, the variable fluorescence yields remained relatively constant while O_2 flash yields decreased. These results strongly suggest that there is a cyclic electron flow around photosystem II in unpoisoned intact cells at light saturation and supraoptimal light intensities.

10024 **Control analysis of red cell glycolysis: combined NMR and computer modeling studies.** Yoshida, T.; Brainard, J.R.; Hutson, J.Y.; Fee, J.A. (Los Alamos National Lab., NM). *Federation Proceedings, Federation of American Societies for Experimental Biology;* **45**: No. 6, 1840(May 1986). (CONF-8606151—).

From 76. annual meeting of the Federation of American Society for Experimental Biology; Washington, DC, USA (8 Jun 1986).

Obtaining a quantitative description of metabolic regulation is essential in understanding metabolic systems under perturbed conditions such as ischemic myocardial tissues. The authors have implemented a mathematical model of glycolysis in human erythrocytes described by Holzhuetter et. al. in order to study the change of regulation pattern during perturbed conditions. Holzhuetter's model as well as a similar model described by A. Werner and R. Heinrich, which takes into account the osmotic state of erythrocytes, predict that the flux of glycolytic pathway increases as the rate of ATP-consuming process increases. The authors have measured the glycolytic flux using ^{13}C NMR with valinomycin as a perturbant to increase the Na^+/K^+ ATPase activity. Upon the addition of valinomycin, increased glycolytic flux and decreased steady state concentration of ATP was observed. Currently, the authors are implementing a more advanced model based on Werner and Heinrich to simulate the effect of valinomycin and study the possible change of distribution of control points along the metabolic pathway.

10025 **Leaf and stem CO_2 uptake in the three subfamilies of the Cactaceae.** Nobel, P.S.; Hartsock, T.L. (Univ. of California, Los Angeles). *Plant Physiology;* **80**: No. 4, 913-917(Apr 1986). Contract AC03-76SF00012.

Net CO_2 uptake over 24-hour periods was examined for the leaves and for the stems of 11 species of cacti representing all three subfamilies. For Pereskia aculeata, Pereskia grandifolia, and Maihuenia poeppigii (subfamily Pereskioideae), all the net shoot CO_2 uptake was by the leaves and during the daytime. In contrast, for the leafless species Carnegiea gigantea, Ferocactus acanthodes, Coryphantha vivipara, and Mammillaria dioica (subfamily Cactoideae), all the shoot net CO_2 uptake was by the stems and at night. Similarly, for leafless Opuntia ficus-indica (subfamily Opuntioideae), all net CO_2 uptake occurred at night. For leafy members of the Opuntioideae (Pereskiopsis porteri, Quiabentia chacoensis, Austrocylindropuntia subulata), at least 88% of the shoot CO_2 uptake over 24 hours was by the leaves and some CO_2 uptake occurred at night. Leaves responded to the instantaneous level of photosynthetically active radiation (PAR) during the daytime, as occurs for C_3 plants, whereas nocturnal CO_2 uptake by stems of O. ficus-indica and F. acanthodes responded to the total daily PAR, as occurs for Crassulacean acid metabolism (CAM) plants. Thus, under the well-watered conditions employed, the Pereskioideae behaved as C_3 plants, the Cactoideae behaved as CAM plants, and the Opuntioideae exhibited characteristics of both pathways.

10026 **Reconstitution of the light harvesting chlorophyll a/b pigment-protein complex into developing chloroplast membranes using a dialyzable detergent.** Darr, S.C.; Arntzen, C.J. (Michigan State Univ., East Lansing). *Plant Physiology;* **80**: No. 4, 931-937(Apr 1986). Contract AC02-76ER01338.

Conditions were developed to isolate the light-harvesting chlorophyll-protein complex serving photosystem II (LHC-II) using a dialyzable detergent, octylpolyoxyethylene. This LHC-II was successfully reconstituted into partially developed chloroplast thylakoids of Hordeum vulgare var Morex (barley) seedlings which were deficient in LHC-II. Functional association of LHC-II with the photosystem II (PSII) core complex was measured by two independent functional assays of PSII sensitization by LHC-II. A 3-fold excess of reconstituted LHC-II was required to equal the activity of LHC developing in vivo. It is suggested that a linker component may be absent in the partially developed membranes which is required for specific association of the PSII core complex and LHC-II.

5506 Medicine

REFER ALSO TO CITATION(S) 9512, 10024, 10057, 10058

10027 **(BNL—37361) Boronated dextran-monoclonal antibody conjugates for NCT.** Elmore, J.J. Jr.; Borg, D.C.; Gabel, D.; Fairchild, R.G.; Temponi, M.; Ferrone, S. (Brookhaven National Lab., Upton, NY (USA); Bremen Univ. (Germany, F.R.). Abt. fuer Chemie; New York Medical Coll., Valhalla (USA). Dept. of Microbiology and Immunology). 1985. Contract AC02-76CH00016. 24p. (CONF-8510315—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003225.

From 2. international symposium on NCT; Tokyo, Japan (1 Oct 1985).

Monoclonal antibodies (MoAbs) to tumor-associated antigens are attractive carriers for concentrating ^{10}B in target tissues. Since coupling of ^{10}B compounds directly to MoAb in amounts sufficient for radiotherapy appears to lead to inactive complexes, we have used detrans as intermediate carriers to allow high levels of ^{10}B to be carried by MoAbs while modifying fewer amino acid residues. Three to five periodate-oxidized dextrans have been attached to anti-IgM polyclonal (IgG) antibodies, followed by coupling of a benzylamine derivative of decachlorocarborane to the extent of ca. 1000 boron atoms per IgG molecule. 41 refs., 1 fig., 1 tab.

10028 **(BNL—38902) Lead nephropathy: In vivo x ray fluorescence (XRF) for assessing body lead stores.** Wedeen, R.P.; Batuman, V.; Quinless, F.; Williams, F.H. Jr.; Bogden, J.; Schidlovsky, G.; Jones, K.W. (Brookhaven National Lab., Upton, NY (USA); Veterans Administration Medical Center, East Orange, NJ (USA); University of Medicine and Dentistry of New Jersey, Newark (USA)). 1986. Contract AC02-76CH00016. 11p. (CONF-8609203—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003200.

From International symposium on in vivo body composition studies; Upton, NY, USA (28 Sep 1986).

The EDTA lead mobilization test has proven of value in the diagnosis of renal disease due to lead (lead nephropathy) but is unsuitable for large scale studies in patients with end-stage renal disease. A rapid, safe, non-invasive technique for determining body lead stores by in vivo tibial x ray fluorescence (XRF) is described. These studies show that the chelation test can be replaced by in vivo XRF in patients with end-stage renal disease. XRF, for the first time, will permit epidemiologic studies of large populations which may be at risk for lead nephropathy from excessive exposure to environmental lead. 15 refs., 2 figs.

10029 **(BNL—38929) In vivo bone aluminum measurements in patients with renal disease.** Ellis, K.J.; Kelleher, S.P. (Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Stony Brook (USA). Health Science Center). 1986. Contract AC02-76CH00016. 12p. (CONF-8609203—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003198.

From International symposium on in vivo body composition studies; Upton, NY, USA (28 Sep 1986).

Contamination of the dialysis solution with trace amounts of aluminum and long-term use of aluminum-based phosphate binders have led to increased body burden of aluminum in patients with end-stage renal disease. A significant clinical problem associated with aluminum-overload is the early diagnosis of aluminum-induced dialysis dementia and osteomalacic osteodystrophy. There are few, if any, blood or urine indices that provide an early monitor of this bone disease, especially in the asymptomatic patient. Although a bone biopsy is usually the basis for the final clinical diagnosis, this procedure is not recommended for routine monitoring of patients. The present technique demonstrates the direct in vivo measurement of bone aluminum levels in patients with renal failure. The interference normally present from activation of bone phosphorus is eliminated by using a thermal/epithermal neutron beam. For the clinical management of the patients, the Al/Ca ratio for the hand may be more useful than an absolute measurement of the total body or skeletal aluminum burden. The relationship between the increased serum Al levels following disferrioxamine infusion and the direct in vivo measurement of bone aluminum using the Al/Ca ratio are currently under investigation. The neutron activation procedure presented in this pilot study is a promising new technique with an immediate clinical application. 5 refs., 3 figs., 1 tab.

10030 (CEA-CONF—8350) **31-P Relaxation times of metabolic compounds in tumors grafted in nude mice.** Remy, C.; Benabid, A.L.; Jacrot, M.; Riondel, J.; Albrand, J.P.; Decorps, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Aug 1985. 3p. (CONF-8508180—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750270.

From 4. annual meeting of the Society of Magnetic Resonance in Medicine; London, UK (19 Aug 1985).

The observation that water proton relaxation rates were longer in tumors than in normal tissues provided a basis for the detection of human tumors by the NMR imaging technique. To evaluate the potentiality of 31-P NMR spectroscopy as a diagnostic tool of the pathological state of tissues, T1 and T2 relaxation times have been measured for the phosphates of ATP, inorganic phosphate (Pi), phosphomonoesters (PME) and phosphocreatine (PCr) in the 31-P NMR spectra obtained in vivo for normal rat brain and rat brain tumors implanted in nude mice.

10031 (DOE/ER/60401—2) **The development of fluoroandrogens and fluoroprogestins as potential imaging agents for receptor-positive prostate and breast tumors.** Brandes, S.J.; Katzenellenbogen, J.A. (Illinois Univ., Urbana (USA)). 1986. Contract FG02-86ER60401. 2p. (CONF-8606111—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001928.

From 6. international symposium on radiopharmaceutical chemistry; Boston, MA, USA (29 Jun 1986).

In designing fluorine-substituted ligands for androgen receptor (AR) and progesterone receptor (PR), we considered those features reported to enhance the binding affinity and selectivity of the ligands to their respective receptors and decrease their affinity for other receptor systems. Thus, AR-selective ligands might include a 17α-hydrogen, 4,5-dihydro moiety or the absence of 19-methyl, and PR-selective ligands might have an ethynyl, another large, unsaturated alkyl group, or a halomethyl in the 17α-position, an alkyl group in the 16α-position and/or 10β-hydrogen. From the limited number of reports concerning the binding of fluorine-substituted androgens and progestins to their respective receptors, it was apparent that fluorine is well-tolerated at numerous sites. We therefore prepared androgens and progestins substituted with fluorine at positions where F-18 might ultimately be introduced in a facile manner. The structures of these compounds and their affinities for progesterone, androgen and estrogen receptors, obtained from in vitro radiometric competitive binding assays using cytosol from estrogen-induced female rats, rat ventral prostate and lamb uterus, are listed. 9 refs., 1 tab.

10032 (INIS-BR—537-Vol.2, pp vp) **Coupling two iteratives algorithms for density measurements by computerized tomography.** Silva, L.E.M.C.; Santos, C.A.C.; Borges, J.C.; Frenkel, A.D.B.; Rocha, G.M. (Rio de Janeiro Univ., Brazil. Coordenacao dos Programas de Pos-graduacao de Engenharia; Rio de Janeiro Univ., Brazil. Faculdade de Medicina). 1986. (In Portuguese). NTIS (US Sales Only), PC A19/MF A01. File Number DE87700036. (CONF-860343—Vol.2).

From 1. general congress on nuclear energy; Rio de Janeiro, Brazil (17 Mar 1986).

This work develops a study for coupling two iteratives algorithms for density measurements by computerized tomography. Tomographies have been obtained with an automatized prototype, controlled by a microcomputer, projected and assembled in the Nuclear Instrumentation Laboratory, at COPPE/UFRJ. Results show a good performance of the tomographic system, and demonstrate the validity of the method of calculus adopted.

10033 (INIS-mf—10512, pp 53) **Dependence of the ^{1}H-NMR relaxation times on measurement temperature and autolysis.** Moser, E.; Echsel, H. (Vienna Univ., Austria). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10034 (INIS-SU—369, pp 81-85) **Production of short-living and ultrashort-living radionuclides for medicine.** Chuvilo, I.V.; Gol'din, L.L.; Khoroshkov, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1985. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE87780052. (CONF-8410203—Vol.2).

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

The status on production of short-living and ultrashort-living radionuclides is considered for application in medicine as a adioisotope diagnostics. A design of specialized proton accelrating complex for medicine on the base of MGTs-20 cyclotron with 250 MeV energy is proposed. The MGTs-20 cyclotron will ensure several doseus of diagnostic procedures a day.

10035 (INIS-XN—33) **Health (Radiation Safety) (Large Aperture Scanners-Amendment) Regulations 1985 (Victoria) Statutory Rules 1985 No. 433.** (International Atomic Energy Agency, Vienna (Austria)). 17 Dec 1985. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700301.

The objective of these Regulations is to remove large aperture scanners from hospitals classified as Category I private hospitals by the Minister of Health.

10036 (INIS-XN—34) **Health (Radiation Safety) (Amendment) Regulations 1985 (Victoria) Statutory Rules 1985 No. 40.** (International Atomic Energy Agency, Vienna (Austria)). 5 Feb 1985. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700302.

These amendments further clarify certain provisions of the Health (Radiation Safety) Regulations 1984, notably regarding angiography installations and fluoroscopy facilities.

10037 (INIS-XN—35) **Health (Radiation Safety) (Further Amendment) Regulations 1985 (Victoria) Statutory Rules 1985 No. 258.** (International Atomic Energy Agency, Vienna (Austria)). 25 Jun 1985. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700303.

These amendments further clarify certain provisions of the Health (Radiation Safety) Regulations 1984, notably regarding licensing and registration procedures.

10038 (LA-UR—86-3744) **Analysis of the human electroencephalogram with methods from nonlinear dynamics.** Mayer-Kress, G.; Holzfuss, J. (Los Alamos National Lab., NM (USA); Observatoire de Nice, 06 (France); Goettingen Univ. (Germany, F.R.)). 8 Sep 1986. Contract W-7405-ENG-36. 12p. (CONF-8609205—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002928.

From Conference on temporal disorder in human oscillatory systems; Bremen, F.R. Germany (8 Sep 1986).

We apply several different methods from nonlinear dynamical systems to the analysis of the degree of temporal disorder in data from human EEG. Among these are methods of geometrical reconstruction, dimensional complexity, mutual information content, and two different approaches for estimating Lyapunov characteristic exponents. We show how the naive interpretation of numerical results can lead to a considerable underestimation of the dimensional complexity. This is true even when the errors from least squares fits are small. We present more realistic error estimates and show that they seem to contain additional, important information. By applying independent methods of analysis to the same data sets for a given lead, we find that the degree of temporal disorder is minimal in a "resting awake" state and increases in sleep as well as in fluroxene induced general anesthesia. At the same time the statistical errors appear to decrease, which can be interpretated as a transition to a more uniform dynamical state. 29 refs., 10 figs.

10039 (ZfI-Mitt—110, pp 227-266) **^{15}N-/sup n/X-multiple labelling in human metabolic research.** Krumbiegel, P. Dec 1985. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87780039.

In Report of the Central Institute for Isotope and Radiation Research.

A short review is given on multiple isotopic labelling techniques - with one of the isotopes being ^{15}N - in human metabolic investigations. Publications of the given field are classified and attached to six labelling methods (e.g., using a mixed labelled compound in one experiment or using simply but different labelled compounds in simultaneous or in subsequent experiments). From tabular surveys, the development of knowledge in this field can be seen. 76 refs.

5507 Microbiology

REFER ALSO TO CITATION(S) 8816, 9047, 10012, 10013

10040 **Three-dimensional structure of the surface layer protein of Aquaspirillium serpens VHA determined by electron crystallography.** Dickson, M.R.; Downing, K.H.; Wu, W.H.; Glaeser, R.M. (Univ. of New South Wales, Sydney, Australia). *Journal of Bacteriology;* **167**: No. 3, 1025-1034(Sep 1986). Contract AC03-76SF00098.

The three-dimensional structure of the protein which forms the S layer of Aquaspirillium serpens strain VHA has been determined by electron microscopy. Structures have been reconstructed to a resolution of about 1.6 nm for single-layered specimens and about 4 nm for two-layered specimens. The structure, which has hexagonal symmetry, consists of a core in the shape of a cup, with six projections arising from the rim of the cup to join adjacent subunits at the threefold symmetry axes. The model is consistent with edge views of the S layer which have been obtained in this and other work. It is now clear from this work and from three-dimensional reconstructions of other bacterial S layers that a wide diversity exists in the morphology of surface layers.

5508 Morphology

REFER ALSO TO CITATION(S) 10040

5510 Physiological Systems

REFER ALSO TO CITATION(S) 10038

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 10000

10041 (PPA-BEN—3, pp 104-127) **Importance of mineral in animal foodstuff and its status in ruminants breeding in Malaysia.** Wan Zahari Mohamed. (Malaysian Agricultural Research and Development Inst., Serdang, Selangor, Malaysia). 1985. (In Malay). NTIS (US Sales Only), PC A09/MF A01. File Number DE87780031. (CONF-8502142—).

From Workshop on scope and technical application of neutron activation analysis; Bangi, Selangor, Malaysia (5 Feb 1985).

A major constraint to maximizing productivity in ruminants in most developing countries are mineral imbalances; specifically deficiencies and toxicities. This paper attempts to present a comprehensive account of their occurrences and the severity of mineral deficiencies in grazing ruminants in Malaysia, based on studies under extensive management and improved feeding systems. The importance of minerals in the nutrition of these animals will be highlighted. Data of mineral levels in the blood and tissues of indigenous swamp buffaloes (Bubalus bubalis), Kedah-Kelantan cattle, sheep and goats will be presented. This paper will also review the mineral levels in animal tissues, plants and soil and usage of these data for predicting the mineral status of ruminants as well as the methods of mineral supplementation for deficient animals.

10042 (ZfI-Mitt—114) **^{15}N in biological nitrogen fixation studies. A bibliography.** Faust, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). May 1986. 120p. NTIS (US Sales Only), PC A06/MF A01. File Number DE87700221.

A bibliography with 298 references on the use of the stable nitrogen isotope ^{15}N in the research on the biological fixation of dinitrogen is presented. The literature pertaining to this bibliography covers the period from 1975 to the middle of 1985.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 9609, 9912

10043 (AD-A—172431/9/XAB) **Fission-track assay for fissile nuclides in tissue. Final comprehensive summary report, 1 July 1982-30 June 1985 on Phases 1 and 2.** Paschoa, A.S.; Smith, J.M.; Bruenger, F.W.; Burdett, R.S.; Williams, F.H. (Utah Univ., Salt Lake City (USA). Coll. of Medicine). 15 Sep 1985. 55p. NTIS, PC A04/MF A01.

Fundamental techniques for a Fission Track Assay for Fissile Nuclides in Tissue were developed. Accomplishments can be summarized as follows: Pu and U were chemically separated from each other and from bulk contaminants frequently encountered in ashed tissue specimens. The preparation of sample-detector assemblies was standardized and conditions for neutron irradiation, subsequent track etching, and quantification were established. Program-controlled procedures were developed to eliminate erroneous interpretations of fission-track images and to guarantee the statistical validity of the track quantitation. The background due to external contamination with uranium was reduced to acceptable levels. A survey of Pu distributions in livers, kidneys, spleens, and lungs and skeletons of experimental animals was performed. Reproducibility and accuracy of the assay were tested on small beef-liver samples tagged with 1.0 and 0.1 fCi ^{239}Pu and on dry, ^{239}Pu-containing liver powder obtained from the National Bureau of Standards. The Pu distribution and average concentration of six livers of humans from Southern Utah and Northern Utah have been determined and the results were compared with those obtained from the same organs by alpha-spectrometric methods. Presently, the lower limit of the ^{239}Pu quantitation using a reported thermal-neutron fluence of 5 x 10^{17} n/cm^{2} is approximately 1 fg or less than 10^{16} Ci. Thus, Pu resulting from 1/10,000 of the maximum permissible whole body burden of .00000004 Ci could be quantitated in a 100-mg bone specimen, assuming a uniform skeletal deposit of ^{239}Pu.

10044 (CEA-CONF—8458) **Oxygen diffusion-concentration in phospholipidic model membranes. An ESR-saturation study.** Vachon, A.; Lecomte, C.; Berleur, F.; Roman, V.; Fatome, M.; Braquet, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 31p. (CONF-8604272—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750742.

From Congress on ESR of radicals in organic and bio-organic systems; Leeds, UK (14 Apr 1986).

Fully hydrated liposomes of dipalmitoyl-phosphatidylcholine were labelled with 5 (or 7, 10, 12, 16)-doxyl stearic acid at pH 6 and 8, and studied by the continuous wave ESR-saturation technique. The ESR spectral magnitude depends on the hyperfrequency power P and on both T_1 and T_2 relaxation times. Saturation, i.e. the non linearity of the spectral magnitude plotted versus $\sqrt{P}$ can be quantified by a P1/2 parameter (power at which the signal is half as great as it would be without saturation). If we assume T_2 weakly modified by spin exchange between paramagnetic spin probe and oxygen in triplet state, P1/2 is inversely proportional to T_1, and becomes a sensitive parameter to appreciate the oxygen transport (oxygen diffusion-concentration product) inside the bilayers. According to the DPPC bilayer phase transition diagrams, P1/2 (oxygen diffusion-concentration) is related to the thermodynamic state of the membrane. This technique provides further informations on a particular property of a radioprotective agent, cysteamine, which seems to inhibit spin-triplet exchange and hence maximizes T_1 (minimizes P1/2). Since radioprotective agents are known to act by scavenging radiation-induced free radicals and by inhibiting oxygen-dependent free radical processes, such a result may contribute to elucidate radioprotecting mechanisms.

10045 **(CONF-861044—5) Radiation protection guidelines for space missions.** Fry, R.J.M.; Nachtwey, D.S. (Oak Ridge National Lab., TN (USA); National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). 1986. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002815.

From Hanford Life Sciences symposium: radiation protection-a look to the future - celebrating four decades of research at Hanford; Richland, WA, USA (21 Oct 1986).

The National Aeronautics and Space Administration's current radiation protection guidelines were recommended in 1970. The career limit was set at 400 rem. Today, using the same approach as in 1970, but with the current risk estimates, a considerably lower career limit would obtain. Also, there is considerably more information about the radiation environments that will be experienced in different missions than previously. Since 1970 women have joined their ranks. For these and other reasons it was considered necessary to reexamine the radiation protection guidelines. This task has been undertaken by the National Council on Radiation Protection and Measurements Scientific Committee 75 (NCRP SC 75). Below the magnetosphere the radiation environment varies with altitude and inclination of the orbit. In outer space missions galactic cosmic rays, with the small but important heavy ion component, determine the radiation environment. The new recommendations for career dose limits, based on lifetime excess risk of cancer mortality, take into account age at first exposure and sex. The career limits range from 100 rem (1.0 Sv) for a 24 year old female to 400 rem (4.0 Sv) for a 55 year old male compared to the previous single limit of 400 rem (4.0 Sv). The career limit for the lens of the eye has been reduced from 600 rem (6.0 Sv) to 400 rem (4.0 Sv). 20 refs., 1 fig., 7 tabs.

10046 **(CONF-8610178—1) Radiation protection training for diverse general employee populations.** Copenhaver, E.D.; Houser, B.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002169.

From TRADE conference; Las Vegas, NV, USA (27 Oct 1986).

Radiation protection training for the general employee at the Oak Ridge National Laboratory has undergone a great deal of restructuring in the last two years. The number of personnel totally dedicated to nuclear facilities is less than a fifth of our employees and the percentage of contracted employees who are dedicated radiation workers is much smaller. However, the aging of our facilities and increasing emphasis on environmental control means that everyone needs to understand the basics of radiation protection. In accordance with changing DOE guidelines and internal ORNL policies, greater emphasis has been placed on keeping training focused on current issues, training the total workforce, and requiring some type of testing or feedback mechanism. This report describes efforts to instill respect, but not fear, of radiation in the work environment. Flexible tools are being developed to meet this objective for several diverse general employee populations. Continuing efforts include consideration of computer-based training for retraining, developing additional modules for specialized groups and jobs, and testing/documentation appropriate to each population segment. 6 refs.

10047 **(EGG—10282-1130) Digital imagery manipulation and transmission for emergency deployment applications.** Gladden, C.A.; Phillipson, D.S. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1986. Contract AC08-83NV10282. 2p. (CONF-8609147—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002857.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

The Digital Imagery Transmission System (DITS) was designed as a replacement for the older slow-scan system. DITS is an interactive microcomputer graphics system capable of digitizing maps or photographs. Digitized images are stored on a local area network file server and can then be distributed to other units on the system or be transmitted over a dial-grade phone line to a remote site where other DITS terminals exist. A DITS terminal consists of an inexpensive microcomputer, an off-the-shelf RGB monitor and an electronic drawing device for entering overlay data. Hardcopy prints can be obtained in minutes.

10048 **(EIR—590) On the hazards of C-14, H-3 and I-125 incorporated into the genetic matter of the cell nucleus: effects of recoil, transmutation and Auger-electrons as compared with the effects of the beta- and gamma-radiation .** Burkart, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland); Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland). Abt. Strahlenueberwachung). Apr 1986. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700219.

Theoretical considerations and experimental findings lead to estimate the relative biological effectiveness of a C-14-atom incorporated into a DNA molecule in the region of 1 to 1.5 compared with 250 kV X-rays. With an annual dose of about 1 mrad from natural C-14 and about 0.2 mrad from C-14 caused by atmospheric bomb tests and nuclear energy, possibly resulting corrections in the conversion into mrem are insignificant. The exposure to natural and artificially produced H-3 is insignificant due to the large dilution factor with H-1 and H-2 in the environment. A conservative quality factor of 2 for the two radionuclides C-14 and H-3 should take into account all possible additional risks which arise from the partial incorporation into DNA. The disintegration of iodine-125 produces an average of 20 electrons of the lowest energy and leads therefore to a locally well bounded microexplosion with a great many ionizations, radical formations and excitations in a minute volume. In the immediate vicinity of a DNA molecule, this can produce severe local damage such as double strand breaks in the DNA helix which are difficult to repair by the cell. Therefore, the position of I-125 inside a cell is of great importance for the extent of tissue damage. This holds true for all radionuclides causing Auger-electron cascades during decay.

10049 **(GSF—8/86) Risk of somatic late effects in man following incorporation of ^{224}Ra(thorium X).** Wick, R.R.; Chmelevsky, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Pathologie; Wuerzburg Univ. (Germany, F.R.). Inst. fuer Medizinische Strahlenkunde). Mar 1986. 36p. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R., Inst. fuer Pathologie.

1568 ankylosing spondylitis patients, injected with repeated injections of ^{224}Ra for treatment of their disease, have been observed in the GSF (study II). By the end of 1985 3 cases of malignant tumours in the skeleton had been observed, compared to 0 cases in a control group. According to the cancer mortality statistics for the FRG the age-corrected number of spontaneous bone tumours expected would be 0.4-0.7. In contrast, a recent risk estimate from the data of the patient group of study I (SPIESS/MAYS) who were treated with considerably higher doses, suggests an expected number of 5.8 radiation induced bone tumours for the present follow-up tine. Latest observations from that group show that bone tumours may occur up to 33 yr after treatment with ^{224}Ra. Thus, the possibility of additional cases of bone tumours occurring in study II cannot be excluded. One striking observation was that 2 of the 3 skeletal tumours observed in study II were tumours of the bone marrow; there has been only 1 bone marrow tumour in the high dose group (study I) among 56 bone tumours. In addition there have been 6 and 5 leukaemias in the exposure and control group respectively. Of the 6 leukaemias in the exposure group 3 were chronic myeloid leukaemias (CML), whereas among the 5 leukaemias in the control group there was no CML.

10050 (IAEA-HPRA—12) **Health Physics Research Abstracts No. 12.** (International Atomic Energy Agency, Vienna (Austria)). Nov 1985. 244p. NTIS (US Sales Only), PC A11/MF A01. File Number DE87700222.

The No. 12 of Health Physics Research Abstracts is the continuation of a series of Bulletins published by the IAEA since 1967 and which collect reports from Member States on Health Physics research in progress or just completed. The present issue contains 386 reports received up to December 1984 and covering the following topics: personnel monitoring, dosimetry, assessment of dose to man, operational radiation protection techniques, biological effects of radiations, environmental studies, pathways and monitoring, radiation hazards resulting from the operation of nuclear facilities, radiation accidents and emergency plans, epidemiology of radiation damage, optimization of radiation protection, research programs and projects.

10051 (IAEA-R—3355-F) **Influence of gamma-radiation on the biological activity of snake venoms in Peru. Final report for the period 1 December 1982-31 January 1986.** Yarleque Ch, A. (International Atomic Energy Agency, Vienna (Austria)). Mar 1986. 5p. (In English and Spanish). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700267.

Effects of Co-60 gamma radiation on enzymatic, haemorragic and necrotic activities of Lachesis muta and Bothrops atrox venoms was studied at several ranges of irradiation lower than 1.0 Mrad. The radiation produced changes on its enzymatic activities. Irradiation at 0.1 Mrad resulted in the partial or complete inactivation of the following enzymes that are listed in order of increasing sensitivity: exonuclease, phospholipase A, caseinolytic enzyme, thrombinolytic enzyme, fibrinolytic enzyme, 5'-nucleotidase and endonuclease. The enzymatic inactivation was increased with 0.5 and 1.0 Mrad although not in a linear manner. Exonuclease was found to be the most radioresistant. The haemorragic activity was decreased to a greater extent than the necrotic activity. The probable mechanism for the changes in the enzymatic, haemorragic and necrotic activities are discussed.

10052 (IAEA-TECDOC—375, pp 85-93) **Methods of assessment of individual and collective doses to transport workers and members of the public during the transport of radioactive material.** Vohra, K.G.; Subrahmanian, G.; Nandakumar, A.N.; Kher, R.K.; Iyer, S.R.K. (Bhabha Atomic Research Centre, Bombay, India). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

Transport workers handling radioactive cargoes are generally exposed to the highest dose rates of any population group. Methods of assessment of dose received by transport workers are studied to arrive at a useful method. An empirical model based on a detailed work study of individuals handling radioactive cargoes and the exposure rates at various distances from specific individual packages is developed. The personnel doses thus calculated compared reasonably well with the doses recorded on personnel monitoring badges. The personnel doses were also evaluated with reference to the total transport index handled by the workers, yielding results consistent with those reported elsewhere by earlier researchers. For assessing the collective dose to the public due to urban transport of radioactive material, the space around the vehicle transporting cargo was divided into a number of cells of dimensions 1m x 1m. The radiation level in each cell was measured and the pedestrian density along the route was obtained. Using the pedestrian occupancy in the cells and the measured radiation levels, the total dose to the public was assessed. A similar assessment was made with respect to the passengers in the neighbouring vehicles. The suggested method of calculation may aid determination of the route and time of transport and the preferable traffic configuration for the vehicle carrying the radioactive consignments for optimizing the dose to the urban public. 5 refs, 4 tabs.

10053 (IAEA-TECDOC—375, pp 95-103) **Study on the radiation exposure of transport personnel.** Ringot, C. (CEA, 75 - Paris, France). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

The study had the following objectives: Exploitation of the dosimetry results for employees responsible for handling and transporting radioactive materials, radiopharmaceuticals, spent fuel and other radioactive material; Evaluation of the corresponding collective detriment; Formulation of recommendations for optimization studies aimed at reducing these radiation exposures. The results supplied cover three firms which, for the purposes of the study, we shall call A, B and C. Firm A dealt almost exclusively with the conditioning, transport and delivery of radiopharmaceuticals or small sources used in nuclear medicine. Firm B dealt with various types of transport: uranium, plutonium, fresh and spent fuel elements and waste. Overall results are given but a distinction is made between doses received during transport and those arising from handling. Firm C dealt mainly with the transport of nuclear materials (plutonium and enriched uranium).

10054 (IAEA-TECDOC—375, pp 109-118) **Assessment of individual and collective radiation doses to transport workers and population from the transport of radioactive materials.** Piermattei, S.; Mancioppi, S. (ENEA, Rome, Italy). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

The paper deals with the application of the INTERTRAN code to the transport of radioactive materials on Italian territory. Particular attention is devoted to the problems connected with the transport of radioactive wastes, temporarily stored at the production sites, to one hypothetical disposal site. In fact, the exposure of the individuals involved is an important parameter to be considered in order to choose among different hypothetical sites located on the territory. To perform such an evaluation the INTERTRAN code was used. Two different modes of transport: truck and rail plus truck, have been considered. The application of the code is limited to normal conditions of transport. 5 refs, 2 figs, 7 tabs.

10055 (IAEA-TECDOC—375, pp 127-130) **Contribution to population dose from the transport of radioactive materials in the Philippines.** Valdezco, E.M.; Kinilitan, V.; Ilagan, L.; Bernardo, B.C. (Philippine Atomic Energy Commission, Diliman, Quezon City). May 1986. NTIS (US Sales Only), PC A07/MF A01. File Number DE87700224.

In International studies on certain aspects of the safe transport of radioactive materials, 1980-1985. Report of the co-ordinated research programme on safe transport of radioactive materials.

This study was initiated late in the Coordinated Research Programme (CRP), and is expected to continue beyond the termination of the CRP. The study proposes to assess the radiological impact to the population from the transportation of radioactive materials in the Philippines. Actual measurements of radiation dose to transport workers are being undertaken to be correlated with the estimated values that will be derived from INTERTRAN calculations. Results of measurements on transport workers will be extrapolated to account for the total population of the country. To date, the INTERTRAN code has been adopted to the VAX-11/750 computer system with few modifications. Preliminary results have shown reasonable agreement between measured and calculated values of radiation doses of transport workers. More shipment data and other relevant parameters are being collected to ensure validity of results. 3 tabs.

10056 (INIS-mf—10504) **Production, study and use of short-lived nuclides in pure and applied nuclear research.** Bjoernstad, T. (Bergen Univ. (Norway). Dept. of Chemistry; Oslo Univ. (Norway)). 1986. 310p. NTIS (US Sales Only), PC A14/MF A01. File Number DE86752934.

The thesis which is based on 17 published papers, reports on the on-line performance of the fast radiochemical separation system SISAK, technical devlopment in the preparation of sources for beta-particles and neutrons, and on important SISAK system improvements concerning liquid hold-up time. It further reports on the development of new production targets at ISOLDE for 600

MeV proton and 910 MeV ^{3}He-particle irradiations, on tests with a heavy ion beam of 1 GeV ^{12}C-particles, and on the present availability of mass-separated beams of the halogen elements through new ion source development. Some results from nuclear spectroscopic studies of nuclides in selected mass regions when using such new or improved techniques are given. Examples of techniques for practical application of short-lived nuclides in radiochemical analysis and for radiochemical production for medical purposes are presented. 231 refs. Reprints of 17 previously published papers.

10057 (ISS-R—84/4) **Risk-benefit analysis in mammography: A study on the Umbria population.** Antonini, A.; Borio, R.; Pagliochini, C.; Pazzaglia, P.G.; Salvadori, P.; Verdecchia, A. (Perugia Univ. (Italy). Dipartimento di Fisica; Perugia Univ. (Italy). Ist. di Radiologia; Centro di Medicina Sociale e Preventiva, Perugia (Italy); Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica; Istituto Superiore di Sanita, Rome (Italy). Lab. di Epidemiologia e Biostatistica). 9 Jul 1984. 36p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900294.

A risk analysis for mammographic screening has been carried out in Umbria with reference both to the general population and to a more restricted one which was selected on the basis of physical examination results and common risk-factors. Losses of life-expectancy for screened and unscreened subjects have been compared. Leaving out of account economic and social factors, data analysis seems to indicate that for the selected population a one-year periodicity mammographic screening is a proper one if starting at age 31. Concerning the general population, maximum benefit is obtained for a one-year periodicity screening starting at older ages, which depend both on the hypothesized dose (with or without screens) and on the assumed tumor doubling time.

10058 (ISS-T—84/1) **Radiation protection criteria in the medical use of teletherapy equipment.** Belli, M.; Matzeu, M.; Onori, S. (Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica). 2 Jan 1984. 72p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87900293.

This paper reports the criteria to be used to ensure radiation protection in the medical use of teletherapy equipment. This report is intended as a guide for licensing authorities and applications.

10059 (LBL—22416) **Tolerance doses for treatment planning.** Lyman, J.T. (Lawrence Berkeley Lab., CA (USA)). Oct 1985. Contract AC03-76SF00098. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003638.

Data for the tolerance of normal tissues or organs to (low-LET) radiation has been compiled from a number of sources which are referenced at the end of this document. This tolerance dose data are ostensibly for uniform irradiation of all or part of an organ, and are for either 5% (TD_5) or 50% (TD_{50}) complication probability. The "size" of the irradiated organ is variously stated in terms of the absolute volume or the fraction of the organ volume irradiated, or the area or the length of the treatment field. The accuracy of these data is questionable. Much of the data represents doses that one or several experienced therapists have estimated could be safely given rather than quantitative analyses of clinical observations. Because these data have been obtained from multiple sources with possible different criteria for the definition of a complication, there are sometimes different values for what is apparently the same endpoint. The data from some sources shows a tendancy to be quantized in 5 Gy increments. This reflects the size of possible round off errors. It is believed that all these data have been accumulated without the benefit of 3-D dose distributions and therefore the estimates of the size of the volume and/or the uniformity of the irradiation may be less accurate than is now possible. 19 refs., 4 figs.

10060 (PNL-SA—13609) **Partitioning of ^{238}Pu, ^{239}Pu, and ^{241}Am in skeleton and liver of United States transuranium registry autopsy cases.** Kathren, R.L.; McInroy, J.F.; Pixley, M.M.; Swint, M.J. (Pacific Northwest Lab., Richland, WA (USA); United States Transuranium Registry, Richland, WA; Los Alamos National Lab., NM (USA); Northwest Coll. and Univ. Association for Science, Richland, WA (USA)). Jun 1986. Contract W-7405-ENG-36;AC06-76RL01830. 13p. (CONF-8606139—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86012331.

From Health Physics Society meeting; Pittsburgh, PA, USA (29 Jun 1986).

The distribution and concentration of the transuranic elements in humans was studied through analysis of tissues collected from occupationally exposed persons at autopsy. This report describes the results of the evaluation of data from registrants with measurable concentrations of plutonium and americium who had contributed bone and liver specimens to the United States Transuranium Registry. (ACR)

10061 (PNL-SA—13685) **Review of the probability of causation tables.** Traub, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 7p. (CONF-860146—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002710.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Probability of causation refers to a statistical method to determine whether an individual's cancer was caused by a previous exposure to radiation. The probability of causation tables discussed are those described in a report entitled Report of the National Institutes of Health ad hoc Working Group to Develop Radioepidemiological Tables (NIH 1985). This report presents algorithms and data tables that can be used for calculation of a probability of causation.

10062 (PNL-SA—14125) **A comparison of microscopic dose with average dose near high energy heavy ions.** Metting, N.F. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 15p. (CONF-861114—33). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003308.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

Biophysical studies indicate that the mechanisms responsible for radiation effects involve injury to cell substructures much smaller than a cell nucleus. Therefore, in order to understand the molecular mechanisms responsible, it is important to know the amount of dose deposited in the microscopic volumes of interest for a particular biological endpoint. In the case of heavy ion passage through tissue, the local pattern of energy deposition in critical volumes is strongly influenced by the structure of the track. At the Bevalac in Berkeley, a small proportional counter mounted in a large vacuum chamber was used to measure single event energy deposition distributions as a function of the distance radially outward from the primary ion path, for a 1.3 μm diameter site. It was found that the distribution of energy deposited only by delta-rays in the site resembled that of 170 kVp x-rays, and also that the specific energy (microscopic dose) for those sites exceeded the calculated average radial dose by two orders of magnitude at large radial distances. 14 refs., 4 figs.

10063 (RERF-TR—9-85) **Search for genetic effects of atomic bomb radiation on the growth and development of the F_1 generation, 5. Stature of 6- to 11-year-old elementary school pupils in Hiroshima.** Furusho, Toshiyuki; Otake, Masanori. (Radiation Effects Research Foundation, Hiroshima (Japan)). Sep 1985. 33p. (In Japanese and English). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700269.

In a search for possible genetic effects of atomic bomb radiation on the stature of the offspring of A-bomb survivors, a comparative study was made on elementary school pupils 6 to 11 years of age born to exposed and nonexposed parents in Hiroshima. The mean stature and variance for the offspring were determined, and the covariance and correlation were calculated in a comparison between either the values for one parent or the sum for both parents, and those for the offspring. Only a few of the differences in mean stature between exposed and nonexposed groups were statistically significant, but in all instances the difference tends to be larger in the exposed group than in the nonexposed group. Also, only a few of the differences in variance between the two groups were statistically significant, but the variance value of the exposed group was higher. Concerning the difference in correlation (Z transformation) between the two groups, only a very few were statistically significant, but the values of the exposed group were higher. A few of the regression coefficient of variance values were statistically significant and the signs of these regression coefficients were not always in agreement.

10064 (RERF-TR—15-84) **Incidence of female breast cancer among atomic bomb survivors, Hiroshima and Nagasaki, 1950-1980.** Tokunaga, Masayoshi; Land, C.E.; Yamamoto, Tsutomu; Asano, Masahide; Tokuoka, Shoji; Ezaki, Haruo; Nishimori, Issei. (Radiation Effects Research Foundation, Hiroshima (Japan)). Oct 1985. 60p. (In Japanese and English). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700268.

Ascertainment of breast cancer incidence among the cohort of the RERF Life Span Study extended sample identified 574 breast cancers among 564 cases diagnosed during 1950 - 80, of which 412 cancers were reviewed microscopically. There were no dose-dependent differences with respect to diagnostic certainty or histological type. As in previous studies, the dose response appeared to be roughly linear, and did not differe between the two cities. The most remarkable new finding was the emergence of a radiation-related excess among women aged under 10 at exposure. The risk of radiogenic breast cancer appears to decrease with increasing age at exposure, whether expressed in relative or absolute terms. These results suggest that exposure of female breast tissue to ionizing radiation at any age, even during the premature stage, can cause breast cancer later in life, and that the length of time that tumor promoters such as endogenous hormones operate following exposure has an important influence on the development of radiation-induced breast cancer.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 9048, 9510, 9514, 9895, 9900, 9904, 9987, 10028

10065 (AD-A—172198/4/XAB) **Dermal, eye, and oral toxicologic evaluations of brass powder, fog oil, diesel fuel, and their mixtures. Report for 1 May-30 September 1985 on Phase 3.** Mayhew, D.A.; Smith, S.H.; Doyle, G.L.; Kreuger, J.C.; Mellon, K.A. (Bioassay Systems Corp., Woburn, MA (USA)). Dec 1985. 145p. NTIS, PC A07/MF A01.

Five test articles were evaluated to establish their eye and skin irritation potential and their oral and dermal toxicity. The test articles evaluated were as followed: 1) Brass Powder, 2) Fog Oil, 3) Diesel Fuel, 4) 0.75 parts Fog Oil:1 part Brass Powder (w/w mixture), and 5) 0.7 parts Diesel Fuel: 1 part Brass Powder (w/w mixture). Oral studies were conducted utilizing the Fischer-344 albino rat as the test system; all other studies utilized the New Zealand White Albino Rabbit as the test system. Results obtained in these studies are summarized.

10066 (CONF-8512105—, pp 36-38) **Transport and balance of environmental chemicals in sections of agricultural ecosystems.** Fuehr, F.; Steffens, W. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Organic chemicals deriving from many different processes are released into the environment and may be finally deposited on the surface soil. The final fate of these compounds in the agro-ecosystem can only be studied by employing /sup 14/C-labelled compounds since extremely small concentrations are involved. The experiments are conducted in a standardized lysimeter system which has been developed originally for pesticide studies. The lysimeters with 0,5 m/sup 2/ or 1 m/sup 2/ surface area and 110 cm undisturbed soil profile are surrounded by a control area of 3 m in diameter. In these radiotracer experiments the combined effects of the growth factors such as physical, chemical, and microbial processes in the soil, as well as climatic factors, on the soil-plant ecosystem are examined throughout the growing season, including the uptake by rotational crops.

10067 (CONF-8512105—, pp 39-42) **Environmental Hazard Profile of organic chemicals. A first, simple technique for evaluation of xenobiotics.** Freitag, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

The concept of "Environmental Hazard Profile" developed at this Institute has been tested with 100 /sup 14/C-labelled organic compounds. Concentration factors in activated sludge, in algae and fish were determined. The microbial degradation of the chemicals to CO/sub 2/ in activated sludge and the decomposition to CO/sub 2/ under artificial light were determined. Ranking of compounds is given in the order of falling concentration factors and accumulation in rats resp. and decreasing rates of decomposition. Relationship between chemical structure and accumulative and degradative behaviours is demonstrated using some selected groups of chemicals, such as benzenes, phenols, biphenyls and polyaromatic hydrocarbons. Correlations between the octanol/water partition coefficient, concentration factors and rates of decomposition could be established. Evaluation of test compounds was possible using hazard profiles obtained by the sum of single test results.

10068 (CONF-8512105—, pp 43-46) **Xenobiotics and their impact on the aquatic ecosystem of a pond.** Lay, J.-P.; Lang, R.; Peichl, L.; Korte, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

For the investigation of toxic effects on outdoor experiments, we selected rotifers as zooplanctonic testorganisms and Lindane and Kalium-Ethylxanthogenate as model-test-chemicals. In a 10 days screening-test, the insecticide Lindane caused a considerable reduction of rotifers at concentrations in the range of 0,02 and 0,5 mg/l pondwater. A one week test with Xanthogenate (2 resp. 10 mg/l) for the identification of a toxic threshold concentration also showed a drastic reduction of the rotifer population. Furthermore the influence by these chemicals on the complete phyto- and zooplanctonic biomass was tested in 1000 litre "enclosures" for several weeks. After repeated doses of about 2 mg/l Xanthogenate, a considerable decrease in algae, dapnids and rotifers was found.

10069 (CONF-8512105—, pp 52-54) **Significance and problems of ecotoxicity for the assessment of environmental hazards by chemicals.** Rohleder, H.; Benz, J. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Exposure and effects are determinative for the potential environmental hazard, i.e. a substance will endanger the environment only in the case that it rises to concentration levels which can lead to ecological harm. Any attempt to realize this concept makes clear that rough exposure estimates can be derived from simple physicochemical data using appropriate environmental models. However, estimates of effects need for results from more sophisticated and expensive test methods. The corresponding small data base is a limiting factor, especially in view to the so-called "problem of existing chemicals" (80000 in the Federal Republic of Germany). When the environmental hazard potential of a large number of chemicals shall be considered and compared, only toxicological data from single-species tests are at best available. However, the harm to single populations is just one indicator for the effects on structure and function of ecosystems. It can be demonstrated with a simple model, which interrelations are neglected and which direction should be followed for improving the test methodology.

10070 (CONF-8512105—, pp 55-58) **Hygienic significance of indoor exposure to xenobiotics.** Gebefuegi, I. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Indoor chemicals, that means chemicals in enclosed rooms, which were not used professionally, show different pathways of contamination and exposure than chemicals have by professional use. Case studies about indoor pollution were conducted in several houses in order to examine the exposition of the occupier. Results of analysis and model studies show possible pathways of non-occupational exposure. The results show that chemicals with low vapor pressure may concentrate on surfaces, for example on textiles. The exposition of occupier may not only occur by inhalation but also by dermal contact with contaminated textiles. For the assessment of indoor chemicals the whole body intake is much more important than inhalation.

10071 (CONF-8512105—, pp 55-58) **Metallothionein and cadmium in the human renal cortex: The impact of smoking.** Summer, K.H.; Heilmaier, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Postmortem specimens of human kidney cortex of 47 individuals classified according to their smoking habits were analysed for tissue cadmium and cadmium bound to metallothionein. In smokers consuming more than 20 cigarettes/day the mean content of renal cortex cadmium was twice that of non-smokers. More than 50% of renal cortex cadmium was associated with the metallothionein fractions. This value directly correlated with the cadmium content of the kidney cortex ($r=0.932$). With constant amounts of zinc and copper in metallothionein the ratio of zinc and copper vs. cadmium in metallothionein decreased with increasing tissue cadmium. Together with the elevated binding of cadmium to renal cortex metallothionein, cadmium increasingly was bound to non-metallothionein-ligands. The binding of cadmium to metallothionein or non-metallothionein-ligands will determine the toxicity of cadmium in highly exposed individuals.

10072 (CONF-8512105—, pp 64-66) **Short time testing systems as screening methods for carcinogenic environmental chemicals.** Pool, B.L. (Deutsches Krebsforschungszentrum, Heidelberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

The detection of carcinogenic compounds is not accurate in vitro mainly due to two major limitations which involve metabolic activation and genetic endpoint. Nevertheless, the interdisciplinary evaluation of risks from carcinogens also utilizes data on the compounds' activities in short term assays. A systematic approach is presently being employed to determine: a) Mutagenesis in bacteria (study of direct activities, specific modes of metabolic activation), b) DNA-Damage in primary hepatocytes (assessment of activity by cells with complete spectrum of metabolization), c) Detection of selective DNA-amplification (assessment of endpoint with additional relevancy to carcinogenesis). With this approach and inclusion of additional modified test systems it is hoped to achieve a reasonable assessment of genotoxic potential of compounds.

10073 (CONF-8512105—, pp 67-69) **Testing of environmental chemicals in the liver using a short-time test: Dose-effect relationships and risk assessment for man.** Deml, E.; Oesterle, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

A dose-response relationship is evaluated for the promoting activity of polychlorinated biphenyls (PCBs) and chloroform, which are ubiquitous and persistent environmental pollutants by means of a rate liver foci bioassay. Initiation of liver foci was performed by oral application of a single, low dose of diethylnitrosamine to weanling female Sprague-Dawley rats. For PCBs as well as chloroform a dose-dependent promoting effect was found. For PCBs the lowest effective dose was 1 mg/kg b. wt. for a single application, or 430 ug/kg b. wt./day, and for chloroform 100 mg/kg b.wt. for a single application or 30 mg/kg b. wt./day. In comparing the experimental data with the actual contamination, the risk for men is estimated to be very low. The amounts of PCBs as well as chloroform normally taken up by men are far more than a factor of thousand lower than the effective experimental doses. In the case of a high pollution with PCBs however, as happened in the Yusho accident (Japan), the daily intake of PCBs was in the range of the effective doses used in the experiment.

10074 (CONF-8512105—, pp 70-71) **Risk assessment of hepatocarcinogenic substances by means of an analysis of preneoplastic early changes in the liver.** Schwarz, M.; Port, R.; Kunz, W. (Deutsches Krebsforschungszentrum, Heidelberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

Chemical hepatocarcinogenesis is characterized by the early appearance of preneoplastic foci which show characteristically altered enzyme patterns. The analysis of these foci shows a quantitative correlation to later appearing tumours in liver. These analyses can be performed at very low carcinogen levels which are more relevant for humans. Different carcinogens show differing tumour initiating and promoting activities which are already prominent in early preneoplastic foci.

10075 (CONF-8512105—, pp 72-73) **Nitrate as a hazard factor for endogenous nitrosamine formation.** Spiegelhalder, B. (Deutsches Krebsforschungszentrum, Heidelberg, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

10076 (CONF-8512105—, pp 74-77) **Early detection of damage to environment and health.** Schmidt-Bleek, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R. Auswertungsstelle fuer Strahlendosimeter). 1985. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750805.

From Lecture meeting on environmental chemicals - their impacts and pathways; Bonn, F.R. Germany (12 Dec 1985).

A new project has been established at the GSF to develop a concept for the early recognition of signals for unwanted changes in the area of health and in the environment. This paper contains on outline of scope and approaches.

10077 (CONF-8610171—1) **Toxicological interactions and the pathogenesis of acute and chronic lung injury.** Witschi, H.P. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001827.

From Workshop on concepts in inhalation toxicology; Albuquerque, NM, USA (20 Oct 1986).

Several generalizations e adnan be drawn with regard to the role of toxicological interactions in the pathogenesis of acute and chronic lung injury. There are no "toxicological interactions" per se. In lung, elsewhere it is a biological response which is amplified through the combined action of two or more agetns. Before one can look for or study "interactions," one has to know and to define exactly the nature of the biological response. In order to define interactions, one needs to have numerical measurements which have a rather great discriminatory power. Interactions are, as was shown in the studies on BHT-oxygen induced lung damage, best defined and described through exhaustive dose-response and time-response studies. Experiments designed to test for interactions can become rather complex, technically demanding and often prohibitively expensive. Statistical considerations and guidance can help in both experimental design and data analysis. However, the best test which lets us decide whether conclusions drawn from an experiment should be accepted is whether the conclusions and data been confirmed independently. Reproducibility and repeatability of findings and data are the true fundamentals of experimentation. 60 refs., 5 figs., 1 tab.

10078 (DOE/EV/10430—T1) **[Isolation and characterization of vanadium binding components in rat tissue and blood]: Final technical report.** (California State Univ., Northridge (USA)). [1986]. Contract AC03-80EV10430. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003182.

It has substantiated by gel chromatography and electrophoresis that >90% of the vanadium found in rat blood is associated with the plasma protein transferrin. Equilibrium dialysis experiments indicate two equivlent binding sites per transferrin for vanadium. Following the intravenous injection of radiolabeled vanadium (V) into rats, vanadium shows a preference for the liver and kidneys. Within the liver tissue the majority of the vanadium is associated with the subcellular nuclear fraction. The subcellular distribution of vanadium in kidney tissue is more uniform with some preference for the nuclear and soluble fractions. Rat liver cytosol appears to contain two vanadium binding components, one identified by gel chromatography as being ferritin, the other with a molecular weight in the range of 70,000-85,000 daltons and possibly being liver transferrin. Vanadium (V) was also shown to bind to lactoferrin in vitro, at apparently two-non-equivalent binding sites. 4 refs., 1 fig., 1 tab.

10079 (GSF—4/86) **Investigations in the analysis, metal storage, and induction of metallothionein.** Heilmaier, H.E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). 1986. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750797.

This work had the object of improving, where possible, the testing and verification procedure for metallothionein and obtaining an overview of the part played by the protein in the storage and transport of essential and toxic metals and its induction through chemicals and metals in different in vitro and in vivo systems. A metallothionein determination test for rapid execution was developed that is sensitive enough to determine metallothionein contents from 2 μg/g of fresh weight upwards. The test has proved sensitive enough to detect the protein in 11 mammalian tissues so far investigated.

10080 (PB—87-100590/XAB) **Effect of age on sensitivity of daphnia magna to cadmium, copper and cyanazine.** Nebeker, A.V.; Cairns, M.A.; Onjukka, S.T.; Titus, R.H. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). 1986. 6p. (EPA—600/J-86/131). NTIS, PC A02/MF A01.

Daphnia magna were exposed to cadmium, copper, and cyanazine to determine the relative sensitivities of several age groups: less than 4 h, less than 24 h, 1 d, 2 d, 3 d, 4 d, 5 d, and 6 d old. Mean cadmium 48-h EC50 values for each age group ranged from 23 to 164 micrograms/L. Mean copper EC50 values ranged from 6 to 18 micrograms/L. Cyanazine EC50 values ranged from 53 to 106 micrograms/L. The 1-d-old Daphnia mean EC50s were 48 and 49 micrograms/L for cadmium, 10 and 10 micrograms/L for copper and 84 and 86 microgram/L for cyanazine, respectively. These similar sensitivities indicate that older animals can be used in tests equally as well as younger animals, thus simplifying the recovery of daphnids in acute sediment toxicity tests.

5604 Other Environmental Pollutant Effects

10081 (IAEA-R—3844-F) **Studies on the cryopreservation of cassava meristems. Final report for the period 1 October 1984-30 September 1985.** Kartha, K. (International Atomic Energy Agency, Vienna (Austria)). May 1986. 2p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700271.

Efforts toward improving the efficiency of the droplet freezing method for the cryopreservation of cassava meristems were undertaken. The use of 15% DMSO as a cryoprotectant resulted in a meristem survival rate ranging from 0 to 38% following retrieval from liquid nitrogen and culturing on solid OMS medium. A method using a freezing solution consisting of OMS medium with 1 M sorbitol, 9% sucrose and 5% DMSO resulted in the highest survival rates (up to 62%).

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 10009

10082 (EGG—10282-1125) **Image/data storage, manipulation and recall using video/computer technology for emergency applications.** Thorpe, J.M. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1986. Contract AC08-83NV10282. 3p. (CONF-8609147—9). NTIS, PC A02. File Number DE87002861.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

Employing a blend of broadcast video and state-of-the-art computer technology the Management Emergency Response Information System (MERIS) is designed to control, manipulate, and distribute the graphic and visual information necessary for decision-making in an emergency response situation or exercise. Instant storage and recall of an extensive library of frames of video imagery allow emergency planners the time and freedom to examine necessary information quickly and efficiently.

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 9025

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 8974, 8985, 8986, 9956, 10100, 10102, 10103

10083 (DEMO—84/9-E) **Investigation on the possible interconnection between Kanata sinkhole, on the high plateau of Tripolis, and springs of Argos area.** Leontiadis, I.; Dimitroulas, C.; Zouridakis, N.; Dounas, A.; Morfis, A.; Paraskevopoulou, P. (Democritos Nuclear Research Center, Athens (Greece). Chemistry Dept.; Institute of Geology and Mineral Exploration, Athens (Greece). Hydrology Dept.). Jul 1984. 30p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87900232.

^{51}Cr-EDTA has been used as tracer for the investigation of possible interconnection between the sinkhole Kanata, on the high Plateau of Tripolis, and springs of the areas of Argos, Achladokambos and Kinouria. By this experiment, the interconnection between the sinkhole and the submarine spring of Kiveri, as well as the springs of Xovrios Achladokambos river, is proved. Furthermore, the percentage of connection between the sinkhole and the springs, the mean transit time of the water from the sinkhole to the springs, the volume of the underground reservoir feeding the springs, etc., have been calculated.

10084 (DOE/ER/60197—3) **On the surging potential of polar ice streams: Part 2, Ice streams and physical characteristics of the Ross Sea drainage basin, West Antarctica.** Jenssen, D.; Budd, W.F.; Smith, I.N.; Radok, U. (Colorado Univ., Boulder (USA). Cooperative Inst. for Research in Environmental Sciences; Melbourne Univ., Parkville (Australia). Dept. of Meteorology). 1985. Contract AC02-84ER60197. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002540.

The West Antarctic region from which ice drains into the Ross Sea is described and analyzed on a twenty km grid with the assumption that the ice is in a steady state of zero overall mass balance. The most striking features of the basin are five major ice streams moving in their lower reaches with velocities two orders of magnitude larger than the ice in which they are embedded. These high velocities are produced by driving stresses which markedly decrease downstream; this suggests that basal sliding takes over from internal deformation as dominant mode of flow. Algebraic expressions for both velocity components are given in terms of the downslope driving (or basal shear) stress, the ice thickness excess above the maximum thickness that can float on rock below mean sea level ("thickness above buoyancy"), and the basal temperature. Thus computed the velocities agree broadly with those derived directly from the condition of steady-state mass conservation ("balance velocities") but there remain large local discrepancies. The latter fully define the three-dimensional strain rate fields and permit the residence times and ages of the ice to be estimated. They also enter into solutions of thermodynamic energy balance equations which give the temperatures in the ice and define regions where basal melting can be expected to occur for different values of the geothermal heat flux. The associated melt water layer is the key feature for a deeper understanding of the sliding and surging processes in ice streams and for improving the agreement between modeled and observed ice velocities.

10085 (GSO—1985-0096, pp vp) **Proterozoic volcanism and its relationship to sulphide mineralization in Bushmanland.** Reid, D.L. (Cape Town Univ., South Africa. Dept. of Geochemistry). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

This report covers geochemical and isotopic studies of metavolcanic suites that constitute a significant proportion of the Precambrian supracrustal rocks in Bushmanland. The specific objectives of this project include the establishment of compositional variation within the metavolcanic suites and to assess the effects of alteration and metamorphism, the establishment of geochemical and isotopic criteria which can be used for characterisation and correlative purposes and to provide a lithogeochemical database, the use of geochemical, age and isotopic data in order to provide constraints on the possible range of petrogenetic models and source rocks and to evaluate the role of these volcanic rocks in terms of the formation of the stratiform sulphide deposits in Bushmanland and in terms of overall crustal development in this region.

10086 (GSO—1985-0096, pp vp) **N-W Cape: Copperton Areachap Cu-Zn mineralization.** Cornell, D.H. (Stellenbosch Univ., South Africa. Dept. of Geology). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

This project provides information as to the nature, source, age and geological context of the rocks that host the massive sulphide ore. The potential of unknown formations are evaluated by testing for geological or geochemical correlation. Methods involved are inductively coupled plasma emission spectrography, electron microprobe analysis and x-ray fluorescence. This project includes aspects of petrography, wholerock and protolith geochemistry, mineral chemistry and isotope chemistry.

10087 (GSO—1985-0096, pp vp) **Geochemical studies on the 'floor' rocks of Namaqualand.** Duncan, A.R. (Cape Town Univ., South Africa). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

Aims of this project include the establishment of the precise nature of the granitoid gneisses that may underlie the mineralised supracrustal rocks of the Aggeneys Subgroup, and to ascertain which of these gneisses represents an older stratigraphic basement to the supracrustal succession, which are part of the supracrustal succession, and which are intrusive into it. This is important since another aim of the National Geoscience Programme is to undertake a basin analysis in order to reconstruct the palaeo-environment of ore deposition. The major aspects of this project are field studies, geochemistry, genesis, correlations and geochronology which refers to the isotopic characteristics and ages of the 'floor' rocks.

10088 (GSO—1985-0096, pp vp) **N.W. Cape: isotope characterization of the base metal mineralization.** Welke, H.J. (University of the Witwatersrand, Johannesburg, South Africa. Bernard Price Inst. of Geophysical Research). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

The main aims of the project on the isotope characterization of the base-metal mineralization in the N.W. Cape are briefly the following: to establish the age, source and mode of origin for the mineralization at Aggeneys and Gamsberg by way of a camprehensive study of the sulphide Pb isotope compositions; to radiometrically date possible basement rocks, cover and intrusive formations of the Bushmanland Sequence in the vicinity of these ore bodies; to relate the Pb initial ratios for the various suites of country and host rocks to the sulphide Pb isotope results.

10089 (GSO—1985-0096, pp vp) **Isotopic and trace element studies of the origin emplacement and deformation of Archaen mineral deposits in the granite-greenstone terrains of the Kaapvaal Craton.** Barton, J.M. (University of the Witwatersrand, Johannesburg, South Africa. Bernard Price Inst. of Geophysical Research). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

The granite-greenstone terrains of the Kaapvaal Craton contain among the oldest metamorphic rocks recognized on Earth and also contain a geographically disproportionately large abundance of mineral concentrations (in particular Au and Sb). However, very little is known about these occurrences as far as the source and age of the rocks in which they occur, the age of the mineralization, the nature and ages of the deformational events affecting the host rocks and the mineralization, the source of the mineralization (in particular Au, Sb and Cu), the mode of concentration of the mineralization, the behaviour of the occurrences in response to metamorphism, why some rocks are mineralized and other compositionally similar rocks are not, and whether or not the occurrences are temporally unique in terms of Earth history, i.e. are they only typical of the Archaean before 3500 Ma ago The objectives of this project were to study these eight aspects.

10090 (NAGRA-NTB—85-01) **Boettstein exploratory well: Report of investigations.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jun 1985. 189p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87900261.

Nagra, the National Cooperative for the Storage of Radioactive Waste, is carrying out a comprehensive geological research program in an area of about 1200 km^2 in northern Switzerland. This study, begun in 1980, will provide the scientific knowledge required to judge the suitability of the subsurface bedrock for the final storage of nuclear waste. The various investigations comprise a program of deep boreholes, a regional geophysical reconnaissance of the petrographic and structural conditions, a hydrogeologic program to classify ground-water chemistry and describe ground-water flow systems in the deep subsurface, and neotectonic observations to detect and measure active crustal movements in the area under study. The Boettstein well was the first borehole on the drilling program. It lies about 10 km to the North of the town of Brugg (Ct. Aargau). Its total depth is 1501 m. This well was drilled to investigate in great detail the sedimentary cover and the uppermost 1000 m of the crystalline basement. An extensive program, comprising continuous coring, sampling of formation fluids, hydraulic testing, and geophysical logging was conducted to provide a solid geologic data base; and to assess the predictive capabilities of the respective analytic methods and investigative tools in order to optimize costs versus benefits in successive wells. Drilling operations at Boettstein started in October 1982 and, with interruptions for scientific investigations, continued until the end of July 1983. Additional tests and surveys were carried out in the completed well until December 1983. Finally, during January 1984 a system of multiple packers was installed in the borehole to observe hydraulic conditions in both the Buntsandstein and crystalline sequence over an extended period of time. The program for these investigations was successfully realized.

10091 **(NAGRA-NTB—85-04) Wet chemistry for Nagra: Research program.** Kussmaul, H.; Antonsen, O. (Institut Fresenius Chemische und Biologische Laboratorien G.m.b.H., Taunusstein-Neuhof (Germany, F.R.); Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jan 1985. 90p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87900316.

Nagra's geological research program is directed toward determination of the possibilities for depositing high-level radioactive waste at depth in northern Switzerland. The program includes ground water analyses for chemical and biological constituents as well as for dissolved gases, uranium, and natural radioactivity. Two sources were utilized to obtain formation waste chemistry in the study area. A regional program was established to investigate mineral and thermal waters. Seventeen sites of the regional program are scheduled for long-term monitoring of water chemistry. A deep drilling program (12 locations projected) was initiated to obtain and analyze water samples from defined depths and formations under in situ conditions. In the regional program, well equipped wells and springs provided representative samples at most locations. However, at other locations impairment of sample quality could not be avoided. Given sufficient water flow, samples for the deep drilling program were taken both at the earth's surface under atmospheric pressure conditions (from artesian outflow or after pumping), and under formation pressure at various depths with specialized sample containers. Finally, this paper also presents some special problems encountered during the deep drilling program. Preliminary results show that no single method can provide completely satisfactory results for all depp drilling water sampling. A combination of procedures and critical evaluation of their respective data can, however, provide valuable information on the chemistry of waters from certain formations.

10092 **(NAGRA-NTB—85-06) Hydrogeological interpretation of the results of isotopic investigations on groundwater from the deep borehole Boettstein.** Balderer, W. (Bern Univ. (Switzerland). Physikalisches Inst.). Jan 1985. 350p. (In German). NTIS (US Sales Only), PC A15/MF A01. File Number DE87900172.

The hydrogeological and hydrogeochemical interpretation of the results of isotopic investigations on groundwater samples from the Nagra deep borehole Boettstein are presented. The Nagra deep borehole Boettstein is the first time it has been possible in Switzerland to investigate and to take groundwater samples from deep sedimentary and crystalline aquifer during drilling. All isotope methods of interest in hydrogeological studies have been applied to investigate these deep groundwaters: ^{2}H, ^{3}H, ^{13}C, ^{14}C, ^{18}O in H_2O, ^{18}O in SO_4, ^{34}S, ^{36}Cl, ^{39}Ar, ^{85}Kr, ^{81}Kr, ^{3}He, ^{4}He, ^{4}He, noble gases, $^{40}Ar/^{36}Ar$ and the isotopes of the Uranium- and Thorium decay series. In addition studies on rock-samples from the drilled core have been carried out as a cross-check for the interpretation of the isotopic results on groundwater samples. Starting from a description of the acceptable limits of contamination of groundwater samples from boreholes for isotope analyses, and the necessary adaptions for sampling on boreholes, the following subjects are treated: description of the basics of each applied method (as far as not already discussed in the report NTB 83-04) and interpretation of the results of each isotope-method for the groundwaters of the different aquifer formations. A synthesis of all results of the different methods, discussed for each aquifer formation is given in the summary chapter. In the final chapter, the conclusions concerning the spatial hydrogeological picture, as far as can be concluded from the results of one borehole, and a first interpretation of the results of the isotopic investigations with the aim to characterize the hydrodynamic flow directions is presented.

10093 **(NAGRA-NTB—85-09) Boettstein hydrogeologic testing of crystalline rocks.** Leech, R.E.J.; Kennedy, K.G.; Gevaert, D. (Gartner Lee Associates Ltd., Markham, Ontario (Canada)). Dec 1984. 169p. NTIS (US Sales Only), PC A08/MF A01. File Number DE87900253.

In addition to comprehensive studies in geology, geophysics, hydrochemistry and rock mechanics, a three-phased program for: (1) drilling; (2) testing; and (3) monitoring of the twelve boreholes was proposed. The Boettstein borehole is located in the central part of the target areas. It was the first borehole to be drilled. Drilling in the crystalline granitic basement rocks started at a depth of 315 m below ground surface in November 1982 and was completed in June 1983 at 1501 m. The testing phase commenced in June and was completed in December 1983. The monitoring phase is ongoing at this time. The study reported here describes the hydrogeologic testing of the crystalline rocks and results of the work done by Gartner Lee AG (GLAG) in the Boettstein borehole on behalf of Nationale Genossenschaft Fur Die Lagerung Radioaktiver Abfalle (NAGRA). This report describes testing equipment and performance. Also included are sections on the testing and analysis methods that were used to determine the hydrogeologic results. Testing was conducted using single and double packer tools with associated down hole and surface electronic equipment. Down hole information from pressure transducers and thermistors were converted from frequency signals to pressure and temperature readings that were printed, plotted and stored on magnetic tape at the surface facility. All the testing equipment worked well.

10094 **(NAGRA-NTB—85-14) Sedimentation and tectonics in the tertiary of northern Switzerland.** Naef, H.; Diebold, P.; Schlanke, S. (Jaeckli (Dr. Heinrich) AG, Zurich (Switzerland)). Mar 1985. 187p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87900260.

The following literature study of the Tertiary of northern Switzerland and its surroundings presents an approach to the problem "sedimentation and tectonics" in the region. As a first fundamental step information has been gathered for the compilation of five litho- and chronostratigraphical correlation charts of the postsiderolithic sediments of northern Switzerland. Uncertainties remain comparing and correlating the different local and regional interpretations of these Tertiary deposits; they cannot always be resolved in a satisfactory manner. In a second part, schematic geological sections have been constructed and then divided into distinct stratigraphic units (Enclosures 5 and 6). Subsidence curves have been determined for a series of points along each section. From those, three-dimensional diagrams of temporal and spatial vertical tectonic movements since the upper Eocene have been reconstructed. These reconstructions indicate that (1) A relatively independent and complicated interference zone extends between the constantly subsiding Molasse through and the rather stable mesoeuropean foreland (Tabular Jura, Black Forest, Swabian Alp). (2) The subsidence curves, together with many hints in published reports, strongly suggest several distinct tectonic phases in northern Switzerland. (3) Some quantitative aspects of the observed tectonic movements in the Tertiary of northern Switzerland and in other well documented regions are discussed and compared with modern geodetic data. Roughly two main tectonic settings can be distinguished: relatively narrow areas with rather local and episodic movements; and wide areas with steady movements during longer periods of time.

10095 **(NAGRA-NTB—85-29) Hydrogeological base for the Oberbauenstock modelling area.** Resele, G.; Tripet, J.P. (Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland)). Apr 1985. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87900254.

For the project "Gewaehr 1985", the data concerning the hydraulic parameters of the host rock (valanginian marls) in the modelling area of Oberbauenstock have been reviewed and processed; the hydraulic conductivities, in particular, have been estimated. The corresponding results are shown in the present report. According to the field observations, the "compact" rock ("rock matrix") is practically impervious and the deep ground water flows in a network of interconnected discontinuities. The valanginian marls show three joint systems of significance for ground water flow. The geometry of these systems is defined in the present report: in particular, it is shown that the joints are closely interconnected. The hydraulic conductivity of the discontinuities is estimated to be K/sub F/ = 3.10^{-9} m/s, the large-scale host rock conductivity $K_0 = 10^{-10}$ m/s with an anisotropy significantly below 10:1. In the vicinity of the existing or possible underground structures as tunnels and caverns, a decompressed zone is produced, whose significance for the hydraulic parameters of the host rock is shown. Observations made on the water inflow from the valanginian marls into the Seelisberg Tunnel have been processed and the seepage rate found to be very limited. The local manifestations of humidity or of drips are well correlated with certain elements of the geological structure and in particular with the thickness of the valanginian marls above the tunnel.

10096 **(USGS-OFR—86-449) Results of recent mapping along the Carpetbag fault system, Yucca Flat, Nevada.** Garcia, M.N.; Sharps, J.A. (Geological Survey, Denver, CO (USA)). 1986. Contract AI08-76DP00474. 14p. US Geological Survey, Box 25425 Federal Center, Denver, CO 80225. File Number TI87001766.

The Carpetbag fault system, a major structural feature in the western part of Yucca Flat on the Nevada Test Site, consists of numerous north-trending fractures and two normal faults that bound a broad, shallow graben. In December 1970, detonation of the Carpetbag event, a subsurface nuclear test, formed the fault scarps at ground surface. Prior to that time, the fault system was only suspected, based on photo lineations and a prominent north-trending gravity high underlying Yucca Flat. Since December 1970, numerous subsurface nuclear tests have been conducted in the vicinity, extending the surface expression of the fault system to the north and south. The area was field checked after each new test within close proximity to the Carpetbag fault system, but the entire system has not been remapped since 1970. A recent mapping project of the fault system combined traditional field mapping with newer photogrammetric techniques. The two techniques produced a faster and more accurate method of mapping young alluvial fault scraps.

5802 Geophysics

REFER ALSO TO CITATION(S) 8934, 8935, 8936, 9875, 10094, 10147

10097 **(CEA-CONF—8380) Contributions to the European workshop on investigation of strong motion processing procedures.** Mohammadioun, B.; Goula, X.; Hamaide, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Nov 1985. 52p. (CONF-8506318—EXC.; CEA-DAS—190). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750714.

From European workshop on investigation of strong motion processing procedures; Roma, Italy (26 Jun 1985).

The first paper is one contribution to a joint study program in the numerical processing of accelerograms from strong earthquakes. A method is proposed for generating an analytic signal having characteristics similar to those of an actual ground displacement. From this signal, a simulated accelerogram is obtained analytically. Various numerical processing techniques are to be tested using this signal: the ground displacements they yield will be compared with the original analytic signal. The second contribution deals with a high-performance digitization complex, custom-designed to stringent technical criteria by the CISI Petrole Services, which has recently been put into service at the Bureau d'Evaluation des Risques Sismiques pour la Surete des Installations Nucleaires. Specially tailored to cope with the problems raised by the sampling of Strong-Motion photographic recordings, it offers considerable flexibility, due to its self-teaching conception, constant monitoring of the work ongoing, and numerous preprocessing options. In the third contribution, a critical examination of several processing techniques applicable to photographic recordings of SMA-1 type accelerometers is conducted. The basis for comparison was a set of two accelerograms drawn from synthetic signals, the characteristics of which were already well known.

10098 **(NAGRA-NTB—84-29) Literature compilation on neotectonics.** Isler, A. (Kellerhals (P.) und Haefeli (Ch.) (Dres.), Geologen, Bern (Switzerland)). Mar 1985. 200p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87900264.

This report provides a review about neotectonic effects and structural elements observed in Switzerland and the bordering countries. It is based on nearly 300 references, which are incorporated as abstracts and summaries. This compilation, which was updated periodically, provided a basis for the neotectonic research program of NAGRA. Uplifts and subsidences, earthquakes, the regional stress pattern in the Earth's crust as well as numerous faults, kakirites, etc., representing a predominantly brittle deformation, are the most described phenomena. Such signs of neotectonic deformation are not only present in the Alps, but also in the foreland plains, in the Jura mountains and in the Southern Black Forest. They are observed throughout the entire rock sequence, i.e., in the crystalline basement as well as in the Mesozoic and Cainozoic strata.

10099 **(PNL-SA—13832) Surface reflectance correction and stereo enhancement of Landsat thematic mapper imagery for structural geologic exploration.** Thiessen, R.L.; Johnson, L.K.; Foote, H.P.; Eliason, J.R. (Pacific Northwest Lab., Richland, WA (USA); Washington State Univ., Pullman (USA). Dept. of Geology). Nov 1986. Contract AC06-76RL01830. 12p. (CONF-8609200—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003095.

From 5. thematic conference on remote sensing for exploration geology; Reno, NV, USA (29 Sep 1986).

Structural remote sensing analysis techniques for exploration have focussed on mapping of crustal fracture zones which can provide pathways for mineralization as well as permeability for movement and/or accumulation of oil, gas, and geothermal fluids. These analyses have relied heavily on manual lineament analysis of enhanced imagery. These image products contain shadow effects that preferentially enhance or suppress lineaments. This study was conducted to evaluate a digital technique for surface reflectance correction for shadows and subsequent stereo enhancement to provide shadow corrected stereo models for structural geologic exploration. Image products were produced from digital Landsat Thematic Mapper (TM) data and a digital elevation model (DEM). The Paiute Ridge quadrangle, Nevada, was selected as a test area for the analysis. Landsat TM data were registered to the DEM and processed to reduce topographic shadowing effects. A Minnaert reflectance model was used to approximate the topographic lighting effects. This reflectance model provided quantitative evaluation of each pixel in the image and was directly used to create a shadow image. These reflectance values were utilized to remove shadow effects from the TM data to produce the corrected surface reflectance. The DEM was used to stereo enhance the shadow corrected TM image. Fracture orientations determined from the original TM and shadow images show similar bias resulting from solar illumination. This bias was not present in the results from the shadow corrected and the corrected stereopair images, with the best correlation to the trends observed in the field data given by the latter.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 10086, 10088, 10089

10100 (GSO—1985-0096, pp vp) **Sulphide mineralization in the Northwest Cape. Acting convenors report for the period 1 July 1983 to 30 June 1984.** Wolhuter, L.E. 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

This convenors report gives an overview on geoscience projects done for the period 1 July 1983 to 30 June 1984 in Korannaland under separate project leaders. These projects include mapping and geochemical work, metamorphic zoning and isotopic studies. Isotopic studies are done on metavolcanic rocks in the Bushmanland supracrustal sequence and the Pb isotope characteristics of the base metal mineralization and of the host and country rocks in Buchmanland are examined. Another project examines the relationship between the palaeosalinity of hydrothermal fluids and sulphide mineralization in the Northwestern Cape.

10101 (GSO—1985-0096, pp vp) **Relationship between hydrated aluminium phosphate-sulphate and sillimanite on Hotson and Koenabib.** Beukes, G.J.; Schoch, A.E.; De Bruiyn, H.; Van der Westhuizen, W.A.; Bok, L.D.C.; Praekelt, H.E. 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

During the investigation of sillimanite containing rocks on the farms Hotson and Koenabib, an exceptional aluminium mineral paragenesis were found. This aluminium paragenesis includes the rare minerals hotsonite, zaherite and natroallanite. Techniques used during the investigation are x-ray diffraction, electron diffraction, x-ray fluorescence spectroscopy, infrared spectroscopy, scanning electron microscopy and differential thermal analysis.

10102 (GSO—1985-0096, pp vp) **Status report: working group on the controls of mineralization in granite-greenstone terraines of the Kaapvaal Craton.** Barton, J.M. 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

This report summarize the activities of the working group on the controls of mineralization in Granite-Greenstone terraines of the Kaapvaal Craton. Some ore deposits in this granite-greenstone terraines have a strong affinity with those formed in modern ocean floor environments and others are associated with felsic volcanic rocks similar to those in modern island arc and Andean-type systems. Most of the deposits, however have been affected by tectonic and metamorphic processes leading to the formation of the craton. These craton forming processes have determined the present disposition of the ore bodies and have been responsible for concentrating elements such as Au and Sb into economically viable ore bodies.

10103 (GSO—1985-0096, pp vp) **NGP, Granite-greenstones: isotope studies of Au and Sb mineralization.** Hughes, M.J. (University of the Witwatersrand, Johannesburg, South Africa. Dept. of Geology). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

This report includes information on the geological, geochemical, mineralogical and Pb, S, C, and O isotope studies of gold, antimony and related mineralization in the Murchison and Barberton greenstone belts. The main aim is to establish, for each of the contrasting types of ore body selected, whether the mineralization is contemporaneous with the host rocks and related to volcano-sedimentary processes, derived from the host rocks and related to volcano-sedimentary processes, but up-graded during later tectonothermal events, or unrelated to the host rocks and entirely introduced from an external source during a later igneous intrusive and/or metamorphic events.

10104 (GSO—1985-0096, pp vp) **Bushveld: sulphides at lower contact.** Maske, S. (University of the Witwatersrand, Johannesburg, South Africa. Dept. of Geology). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

The aim of the study is to identify the mechanisms of formation and concentration of basal sulphide occurrences in layered plutonic complexes, with particular reference to the Bushveld Complex. During the period under consideration (May 1983 to May 1984) attention was directed to the analysis of sulphur and carbon isotopes and the results obtained from boreholes are reported here.

10105 (GSO—1985-0096, pp vp) **Platinum-group element mineralization.** Gruenewaldt, G. (Pretoria Univ., South Africa). 1985. Geological Survey, Private Bag X112, Pretoria, 0001, South Africa.

Published in two parts. Open file 303.

In National Geoscience Programme. Progress Reports 1984.

The purpose of this investigation is to determine the geological processes responsible for the abnormal enrichment of the platinum-group elements (PGE) in the mineralized layers of the Bushveld Complex. Questions asked are: what processes caused enrichment of the Bushveld magma in the PGE; by what processes were these PGE concentrated in the mineralized layers; was contamination of the Bushveld magma from external sources important in the formation of the PGE enriched layers; what are the effects of fractional crystallization on the PGE ratios.

10106 (Juel-Spez—316, pp 263-267) **Magnetic properties of synthetic olivines.** Wacker, K.; Treutmann, W.; Hellner, E.; Reimers, W.; Hosoya, S. (Marburg Univ., Germany, F.R. Inst. fuer Mineralogie, Petrologie und Kristallographie; Dortmund Univ., Germany, F.R.; Sendai Univ., Japan). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The magnetic properties of α-Fe_2SiO_4, α-Co_2SiO_4 and α-Mn_2SiO_4 are measured. They crystallize in the olivine-lattice type. They are found to be paramagnetic at room temperature, and for low temperatures the transition to antiferromagnetism can be confirmed.

10107 (NAGRA-NTB—84-37) **The recent stress field in northern Central Switzerland.** Becker, A.; Bluemling, P.; Mueller, W.H. (Karlsruhe Univ. (T.H.) (Germany, F.R.); Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Sep 1984. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900270.

The regional stress field and its local variation were detected for the northern part of Central Switzerland using an overcoring technique (doorstopper) and the observation of breakouts in deep boreholes. The results were compared with fault plane solutions of earthquakes. In this area at the southeastern end of the Rhinegraben, the stress field is very inhomogeneous. The general direction of the mean stress in Central Europe (N140°E +- 10°) was observed at only one location in the case of the overcoring measurements. All other in-situ (overcoring) measurements are up to 80° off this general direction. These changes of the state of stress near the surface were confirmed by the directions of borehole breakouts in deep wells. The spalling of the borehole wall indicates a stress direction of N160°E +- 10° within a sediment trough and N7°E +- 10 in the sediments on the top of the shearplane of the Jura overthrust. The general direction of the European stress field was measured exclusively in the crystalline basement. This is the first time that a rotation of stress direction with depth has been observed directly. The data indicate the mechanical decoupling of the basement and the sediments. In the area of the Dinkelberg the data of the overcoring measurements show tensile stresses which are in agreement with results of the faultplane solution of normal-fault earthquakes in the area of Wies and Kandern.

10108 (NAGRA-NTB—85-30) **Loosening of tunnel and cavern Valanginien marl at Oberbauenstock.** Gysel, M. (Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland)). Jan 1985. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87900263.

At the Oberbauenstock Type B repository model site for low- and intermediate-level radwaste, tunnels and cavern will be surrounded by decompressed zones which are induced through the stress redistributions caused by the tunnelling action. The following report treats the formation, the extent and the inherent properties of the decompressed, or loosened, zone. The loosening may be accompanied by an increase of the hydraulic permeability (k-value). For the Valanginien marl (host rock), the k-value is considered to change from 10^{-10} m/s to approx. 10^{-7} m/s. The swelling potential of the marl induces the so-called joint swelling in the plastified rock zones; this can reduce the final k-value to 10^{-8} - 10^{-9} m/s. Over long periods of time, creep of the marl under the given overburden stress might, following backfilling of the tunnels and caverns, addditionally reduce the permeability. However, present indications are that the viscosity of the Valanginien marl is too high to allow a significant recompression of the decompressed zones. The permeability, however, may possibly be reduced by grouting techniques. It is proposed to study the mechanisms of rock loosening, joint swelling and creeping in more detail by means of in situ and laboratory investigations. The report includes the large-scale determination of the permeability of naturally jointed rock, making use of seepage measurements on power tunnels in the Swiss Alps. Comparisons may then be carried out between the naturally jointed rock and the "artificially" jointed decompressed rock zone with regard to their permeability.

10109 **(SAND—86-0178C) Effects of changes in normal stress on rock friction.** Olsson, W.A. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 11p. (CONF-870103—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86014141.

From 2. international conference on constitutive laws for engineering materials; Tucson, AZ, USA (5 Jan 1987).

Experimental data on the effects of sudden changes in slip velocity show that most silicate rocks at low normal stress are velocity-weakening; that is, steady-state friction stress decreases with increasing slip velocity. An experimental program has been undertaken to evaluate both the velocity and normal stress history effects in welded tuff, a rock of engineering importance. This paper is largely restricted to the observed effects of normal stress changes. The experiments were done on smooth surfaces of welded tuff in rotary shear with remote angle of rotation and normal stress servo-controlled. Two types of normal stress change experiments were done: (1) those in which normal stress changes, $\Delta\sigma$, were effected during periods of stationary contact, and (2) those in which normal stress changes were carried out at constant sliding velocity controlled at preselected values from 0.1 to 10 μm/s. In this second category of tests, normal stress changes consist of step histories and ramp histories.

10110 **(SAND—86-2110) Release equation of state of dry and water-saturated porous calcite.** Grady, D.E.; Moody, R.L.; Drumheller, D.S. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003589.

Equation of state data on calcite obtained from shock compression and release wave experiments are reported. Powder gun and two-stage gun impact technology along with time-resolved velocity interferometry, are used to produce and measure planar shock and release wave states. Experiments are performed on crystalline calcite and on dry- and water-saturated porous calcite at shock pressures ranging from 10 to 66 GPa. Developmental work required to perform high-pressure shock -wave experiments on porous samples with the two-stage gas gun is described. Lagrangian analysis methods are used to determine pressure-density release paths from measured wave profiles. A high-pressure phase change in calcite has been identified from the release-wave data. Calculational results obtained using a model based on a theory of immiscible mixture are compared with the experimental data.

10111 **(UCID—20937) NMR imaging and spectroscopy for earth sciences: FY86 report.** Harben, P.; Ward, R. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003607.

NMR Imaging has proven to be a unique and powerful tool in medicine for imaging many regions of the body. Very little of this technology has been applied to non-medical applications. Our objective was to develop an NMR Imaging capability at LLNL and to apply it to some general test samples and samples of a particular interest to Earth Science. A Sandia based solids spectrometer was modified to perform NMR Imaging. We built two sample probes and added features to enhance our imaging capabilities such as quadrature phase detection and spin-echo formation. We chose to confine our imaging effort to hydrogen nuclei in mobile water. Several test samples were imaged ranging from small water flasks to a peapod sections with good imaging results. Several NTS welded tuff samples were water saturated and imaging was attempted. Imaging failed on these samples. NMR spectroscopic analysis of the samples indicated two distinct wide water lines of 3 kHz and 13 kHz with no measurable free water. The wide water lines suggest the water is rendered relatively immobile in interacting with the material walls. Further NMR spectroscopic analysis could explain the two water states observed by characterizing the pore size distribution and by observing the change in the line widths with partial saturation.

5804 Geochemistry

REFER ALSO TO CITATION(S) 9244, 9514, 10085, 10087, 10092

10112 **(EGG—10282-1127) Aerial survey efforts in the search for radon contaminated houses in the Reading Prong area near Boyertown, PA.** Hoover, R.A.; Mateik, D.E. (EG and G Energy Measurements, Inc., Suitland, MD (USA). Washington Aerial Measurements Dept.). 15 Sep 1986. Contract AC08-83NV10282. 7p. (CONF-8609147—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002859.

From American Nuclear Society annual meeting; Bethesda, MD, USA (15 Sep 1986).

At the request of the Commonwealth of Pennsylvania, the Department of Energy requested EG & G Energy Measurements to fly an aerial radiological survey over a portion of the Reading Prong near Boyertown, Pennsylvania. The survey goal was to help locate regions where buildings contained elevated levels of radon gas. A 250 km2 area was surveyed. A number of sites were located. These sites correlated fairly well with known geologic faults in the area. 4 refs., 1 fig.

10113 **(NAGRA-NTB—85-05) Sondierbohrung Boettstein: Results of hydrochemical investigations: Analysis and interpretation.** Pearson, F.J. (INTERA Technologies, Inc., Houston, TX (USA)). Jan 1985. 131p. NTIS (US Sales Only), PC A07/MF A01. File Number DE87900244.

During drilling and testing at Boettstein, samples were collected for geochemical and isotopic analysis. The sampling and analytical procedures, and chemical and isotopic results are described in detail in other Nagra Technische Berichte. This report reviews the procedures and analyses and provides a geochemical interpretation of the results. Two sedimentary horizons were sampled: the upper Muschelkalk and the Buntsandstein/weathered crystalline zone. Four sets of samples for geochemical anlayses and five for isotope analyses were taken from the crystalline section above 1000 m. They represented the three zones of highest hydraulic conductivity in that interval. The zones of highest conductivity below 1000 m were also sampled but yielded so little water that only mixtures of formation water and borehole fluid could be collected.

5805 Oceanography

REFER ALSO TO CITATION(S) 9958, 9983

10114 **(UCID—20905) Documentation, critique, and suggested changes in a simple ocean model.** Taylor, K.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002733.

A simple upwelling-diffusion model originally formulated by the NYU modeling group and described in Hoffert et al. (1983) has been rederived and critically analyzed. The purpose was to evaluate how to best incorporate the model into a climate model such as the Livermore Statistical Dynamical Model (LSDM). Hoffert's model was one of the first models to be used to study the question of the transient response of the ocean to climate perturbations. It successfully reproduces the equilibrium temperature structure of the deep ocean. I have found that there are some problems in the formulation of the model when it is applied at individual latitudes. I have offered a simple alternative that allows the thermohaline circulation to vary in such a way as to keep the polar temperature just above the freezing point. I have also corrected some inconsistencies in the poleward heat transport equations. Analytic solutions of the model equations under simple harmonic forcing have been found and can be used to verify the finite-difference schemes of numerical models. Full analysis of a more complex model that includes upwelling driven by surface wind stress has not yet been completed.

64 PHYSICS I

10115 **(INIS-SU—353) Experimental and theoretical physics. Collection.** (AN SSSR, Moscow. Fizicheskij Inst.). 1984. 61p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780034.

Kratkie Soobshcheniya po Fizike. (No. 6).
Individual papers in this collection are abstracted separately.

10116 **(INIS-SU—354) Plasma physics. Collection.** (AN SSSR, Moscow. Fizicheskij Inst.). 1984. 69p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike. (No. 11).
Individual items in scope are processed separately. (DLC)

10117 **(INIS-SU—361) Experimental and theoretical physics. Collection.** (AN SSSR, Moscow. Fizicheskij Inst.). 1984. 57p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780036.

Kratkie Soobshcheniya po Fizike. (No. 8).
Individual items in scope are processed separately. (DLC)

10118 **(INIS-SU—362) Experimental and theoretical physics. Collection.** (AN SSSR, Moscow. Fizicheskij Inst.). 1984. 57p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780037.

Kratkie Soobshcheniya po Fizike. (No. 9).
Individual items in scope are processed separately. (DLC)

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 9025, 9835, 10247, 10388, 10388, 10389, 10464

10119 **(AD-A—172176/0/XAB) Magnetohydrodynamic modeling of solar disturbances in the interplanetary medium. Final report, April 1983-December 1985.** Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). Dec 1985. 32p. NTIS, PC A03/MF A01.

A scientifically constructed series of interplanetary magnetohydrodynamic models is made that comprise the foundations for a composite solar-terrestrial environment model. These models, unique in the field of solar-wind physics, include both 2-1/2D as well as 3D time dependent codes that will lead to future operational status. Also developed was a geomagnetic storm forecasting strategy, referred to as the Solar Terrestrial Environment Model (STEM/2000), whereby these models would be appended in modular fashion to solar, magnetosphere, ionosphere, thermosphere, and neutral-atmosphere models. It is stressed that these models, while still not appropriate at this date for operational use, outline a strategy or blueprint for the future. This strategy, if implemented in its essential features, offers a high probability for technology transfer from theory to operational testing within, approximately, a decade. It would ensure that real-time observations would be used to drive physically based models that outputs of which would be used by space-environment forecasters.

10120 **(AD-A—172219/8/XAB) Development of a CCD based solar speckle imaging system. Final report, 1 March 1983-30 September 1985.** Nisenson; Stachnik, R.V.; Noyes, R.W. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). 3 Feb 1986. 27p. NTIS, PC A03/MF A01.

This report describes the program to develop software and hardware for the purpose of obtaining high-angular-resolution images of the solar surface. The program included the purchase of a charge-coupled-device imaging system; an extensive laboratory and remote site testing of the camera system; development of a software package for speckle-image reconstruction that eventually installed and tested at the Sacramento Peak Observatory; and experiments of the CCD system (coupled to an image intensifier) for low-light-level, narrow spectral-band solar imaging.

10121 **(DOE/ER/40118—4) Field theoretic investigations on particle physics and cosmology: Scientific and technical report for the period of December 1, 1985 to November 30, 1986.** Pi, So-young. (Boston Univ., MA (USA). Dept. of Physics). [1986]. Contract AC02-83ER40118. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003386.

The purpose of this paper is to present a new and more detailed treatment of the quantum mechanical behavior of the inflation-driving scalar field. Understanding the time-development of the scalar field and its quantum fluctuations is crucial to the entire "new inflationary universe" program. The quantum effects are very important for several reasons. First, they control the length of time for which the scalar field remains near the top of the hill in the potential diagram and hence they determine the duration of the inflationary era. In addition, quantum fluctuations provide the source of density fluctuations which are the seeds for the origin of galaxy formation.

10122 **(IPPJ—725, pp 199-209) X-ray spectra of bursting neutron stars.** Ebisuzaki, Toshikazu; Nomoto, Ken-ichi. (Tokyo Univ., Japan. Coll. of General Education). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The global properties of type-I x-ray bursts can be successfully accounted for by the thermonuclear shell flash model of accreting neutron stars. According to this model, the luminosity of a relatively large burst approaches to the Eddington luminosity. We calculate the atmospheric structure and the photon energy spectrum of x-ray bursting neutron star taking account of comptonization. From the x-ray spectrum, theoretical color temperature-luminosity diagram is obtained. Observational color temperature-luminosity diagram of x-ray burster is constructed using data of Japanese x-ray sutellite Tenma. Comparing our theoretical diagram with observational ones, we can estimate a mass-radius relation of neutron stars and distances to the Galactic Center.

10123 **(IPPJ—725, pp 49-65) Numerical simulation in astrophysics. Smoothed particle methods.** Miyama, Shoken. (Kyoto Univ., Japan. Dept. of Physics). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

There have been many numerical simulations of hydrodynamical problems in astrophysics, e.g. processes of star formation, supernova explosion and formation of neutron stars, and general relativistic collapse of star to form black hole. The codes are made to be suitable for computing such problems. In astrophysical hydrodynamical problems, there are the characteristics: problems of self-gravity or external gravity acting, objects of scales very large or very short, objects changing by short period or long time scale, problems of magnetic force and/or centrifugal force acting. In this paper, we present one of methods of numerical simulations which may satisfy these requirements, so-called smoothed particle methods. We then introduce the methods briefly. Then, we show one of the applications of the methods to astrophysical problem (fragmentation and collapse of rotating isothermal cloud).

10124 **(ITP—85-48-E) Dynamical evolution of HI shells and initial mass function OB associations.** Silich, S.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700198.

The evolution of expanding supershells produced by supernovae explosions in OB-associations is considered. It is shown that the narrow range of the observed velocities is naturally explained in the model. The supershells expanding velocities and star mass spectral index obtained from the condition of velocity agree well with observational data. 24 refs.

10125 **(ITP—85-61-E) Cosmological models with coherent scalar field oscillations in fourth-order gravity equations.** Gottloeber, S.; Mueller, V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700247.

Spatially flat Friedman models are driven at early times by coherent scalar field oscillations and the vacuum polarization. Maxima and minima, as well as an inflationary expansion of the scale factor result from both effects. The possibility of a start of the cosmological expansion at a finite bounce is a welcomed property, but in the flat model it leads to an unstable late-time behaviour. 11 refs.; 5 figs.

10126 (KEK—85-4, pp 123-157) **New directions in Kaluza-Klein cosmology.** Yoshimura, M. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

In the first part of this lecture I critically review a naive cosmological model based on higher dimensional Kaluza-Klein theories. Improvement of this model calls for a calculation of a realistic energy-momentum tensor beyond the ideal gas form. Thermal and quantum Casimir energies are then examined and used in integrating the Einstein equation. A possibility of singularity-free cosmologies is pointed out. The talk proceeds as follows: (1). Introduction, (2). Simple Kaluza-Klein Cosmology, (3). Gravitational Casimir Energy, (4). Singularity-Free Vacuum Cosmology, (5). Particle Production and Its Cosmological Implications, (6). Gravity at High Temperatures, (7). Discussion.

10127 (KEK—85-4, pp 158-172) **Dimensional reduction in an oscillatory Kaluza-Klein cosmology.** Ishihara, H. (Hiroshima Univ., Takehara, Japan. Research Inst. for Theoretical Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

It is studied that a dynamical behavior of the higher dimensional space-time whose anisotropy is prevailed all over the spatial dimensions with the topology S_3 x S_3 using the classical Einstein equations. In this model, the universe evolves from an initial Kasner phase to a final one through a (non-chaotic) oscillation phases, from which the dynamical dimensional reduction results.

10128 (N—86-32374) **Boundary conditions for the paleoenvironment: chemical and physical processes in the presolar nebula. Semiannual status report, 16 February-15 August 1986.** Irvine, W.M.; Schloerb, F.P. (Massachusetts Univ., Amherst (USA)). 1986. 11p. (NASA-CR—176870; NAS—1.26:176870; SASR—7). NTIS HC A02/MF A01.

The first interstellar hydrocarbon ring, cyclopropenylidene (C_3H_2) is being studied. Both a survey of galactic sources in several C_3H_2 transitions and a more detailed study of a subset of these sources are under way. In the latter category is a study of the nearby cold dark cloud TMC-1, which is a potential formation site for solar type stars. A spectra is shown of seven rotational transitions which have been observed at the Five College Radio Astronomy Observatory. Three of these were detected for the first time in any astronomical source: the 3 sub 30 to 2 sub 21 transition at 216 GHz, the 2 sub 21 to 1 sub 10 transition at 122 GHz, and the 1 sub 11 to 0 sub 00 transition at 52 GHz. From the data it is apparent that C_3H_2 is quite spacially extended in typical interstellar molecular clouds, and that at least in TMC-1 it is one of the most abundant organic molecules.

10129 (N—86-32375) **Extreme limb profiles of the sun at far-infrared and submillimeter wavelengths.** Lindsey, C.; Becklin, E.E.; Orrall, F.Q.; Werner, M.W.; Jefferies, J.T.; Gatley, I. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Jun 1986. 41p. (NASA-TM—88251; A—86236; NAS—1.15:88251). NTIS HC A03/MF A01.

Thirty, 50, 100, and 200 microns solar limb intensity profiles determined with arcsecond resolution from airborne observations of the occultation of the solar limb during the total eclipse of 1981 July 31 are presented. Two points of particular importance emerge: (1) the longer-wavelength (100 and 200 micron) limbs are significantly brighter than disk center. At 200 microns the extreme limb is about 1.22 times the brightness of disk center. This is consistent with the 6000 K temperature-plateau structure of the model chromospheres of Vernazza, Avrett, and Loeser (1973, Ap. J., 184, 605; 1981; Ap. J. Suppl., 45, 635;) and (2) the longer wavelength limbs are extended significantly further above the visible limb than Vernazza, Avrett, and Loeser predict. These results provide a strong basis for modeling of the solar chromosphere free from the assumption of gravitational-hydrostatic equilibrium.

10130 (N—86-32376) **Ultraviolet observations of astronomical phenomena. Final Report.** Mullan, D.J. (Delaware Univ., Newark (USA)). Sep 1986. 28p. (NASA-CR—176859; NAS—1.26:176859). NTIS HC A03/MF A01.

The purpose was to study various aspects of mass loss in stars of different types. The observational part of the research was directed at three Cepheid variables; the archival part of the research was directed at hot stars (for information on corotating interaction regions) and at cool giants (for study of variability in the mass losing part of the atmosphere).

10131 (N—86-32377) **Definition and empirical structure of the range of stellar chromospheres-coronae across the H-R diagram: cool stars.** Linsky, J.L. (National Bureau of Standards, Boulder, CO (USA)). Sep 1986. 34p. (NASA-CR—176863; NAS—1.26:176863). NTIS HC A03/MF A01.

Major advances in our understanding of non-radiative heating and other activity in stars cooler than T sub eff = 10,000K has occured in the last few years. This observational evidence is reviewed and the trends that are now becoming apparent are discussed. The evidence for non-radiatively heated outer atmospheric layers (chromospheres, transition regions, and coronae) in dwarf stars cooler than spectral type A7, in F and G giants, pre-main sequence stars, and close bindary systems is unambiguous, as is the evidence for chromospheres in the K and M giants and supergiants. The existence of non-radiative heating in the outer layers of the A stars remains undetermined despite repeated searches at all wavelengths. Two important trends in the data are the decrease in plasma emission measure with age on the main sequence and decreasing rotational velocity. Variability and atmospheric inhomogeneity are commonly seen, and there is considerable evidence that magnetic fields define the geometry and control the energy balance in the outer atmospheric layers. In addition, the microwave observations imply that non-thermal electrons are confined in coronal magnetic flux tubes in at least the cool dwarfs and RS CVn systems. The chromospheres in the K and M giants and supergiants are geometrically extended, as are the coronae in the RS CVn systems and probably also in other stars.

10132 (N—86-32378) **Activities of the Department of Astronomy and McDonald Observatory of the University of Texas at Austin. Semiannual report, 1 January-30 June 1986.** Smith, H.J. (Texas Univ., Austin (USA)). 1986. 12p. (NASA-CR—179667; NAS—1.26:179667; SAR—25). NTIS HC A02/MF A01.

Extensive observations of Halley's Comet were obtained. The comet exhibited large variability; moreover, its variability was much more rapid than can be accounted for by water vaporization as the sole controller of activity. Jupiter satellite Io's atmosphere was found to be distended by more than the equilibrium scale height but less than for unimpeded streaming into space. The atmosphere is at least temporarily bound to IO. Uranus' (3-0) H_2 quadrupole line shapes require a modification of Baines and Bergstralh's standard model which incorporates at high altitude absorbing haze in addition to the lower haze layer. A fraction of normal H2 equal to 0.25 + or 0.10 is derived, in good agreement with the standard model. This result is unchanged when the preliminary temperature structure derived by the Voyager Radio Occultation Experiment is used instead of Appleby's model c. Out of the six Pluto-Charon mutual events observed this year, data were obtained on four. Preliminary analysis is yielding improved estimates for the diameters, masses, densities, and albedos of these objects.

10133 (N—86-32381) Reduction and analysis of data from experiment CAI on the IMP-8 mission. Final report, 24 March 1980-31 December 1984. Stone, E.C.; Mewaldt, R.A. (California Inst. of Tech., Pasadena (USA)). 1984. 10p. (NASA-CR—177891; NAS—1.26:177891). NTIS HC A02/MF A01.

The Caltech Electron/Isotope Spectrometer (EIS) on the Interplanetary Monitoring Platform 8 (IMP-8) has provided precise measurements of the energy spectra and time variations of low energy electrons (0.16 to 6 MeV), the isotopes of hydrogen and helium (approximately 2 to 40 MeV/nucleon), and the elements from lithium through oxygen (approximately 5 to 50 MeV/nucleon) in energetic particle fluxes of solar, galactic, interplanetary, and magnetospheric origin since 1973. The accomplishments that have resulted from EIS measurements during the period March 24, 1980 to December 31, 1984 are summarized.

10134 (N—86-32382) A SIRTF interdiciplinary scientist proposal. Semiannual technical report, 1 April-12 September 1986. Wright, E.L. (California Univ., Los Angeles (USA)). Sep 1986. 60p. (NASA-CR—176862; NAS—1.26:176862). NTIS HC A04/MF A01.

Segal's chronometric cosmology provides an adequate fit to the radio source counts only for an unrealistic choice of spectral index. Since the typical observed spectral index of 0.75 gives a completely unacceptable X squared = 136 with 24 (or fewer) degrees of freedom, it is concluded that the actual Universe does not fit the chronometric model. Counts of ultraviolet excess quasistellar objects also show a steep N(S) curve that the chronometric cosmology cannot explain. Claims to the contrary by Segal, Loncaric, and Segal (1980) and Segal and Nicoll (1986) depend on a seemingly innocuous assumption that in fact destroys the power of the N(S) test. Even though the chronometric model gives a better fit that other non-evolving models it must be ruled out along with all non-evolving cosmologies.

10135 (N—86-33260) Cross sections for production of the 15.10 MeV and other astrophysically significant gamma-ray lines through excitation and spallation of ^{12}C and ^{16}O with protons. Lang, F.L.; Werntz, C.W.; Crannell, C.J.; Trombka, J.I.; Chang, C.C. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Sep 1986. 43p. (NASA-TM—87787; REPT—86B0418; NAS—1.15:87787). NTIS HC A03/MF A01.

The ratio of the flux of 15.10-MeV gamma rays to the flux of 4.438-MeV gamma rays resulting from excitation of the corresponding states in C-12 is a sensitive measure of the spectrum of the exciting particles produced in solar flares and other cosmic sources. These gamma rays are produced predominantly by interactions with C-12 and O-16, both of which are relatively abundant in the solar photosphere. Gamma ray production cross sections for proton interactions have been reported previously for all important channels except for the production of 15.10-MeV gamma rays from O-16. The first reported measurement of the 15.10-MeV gamma ray production cross section from p + O-16 is presented here. The University of Maryland cyclotron was employed to produce 40-, 65-, and 86-MeV protons which interacted with CH_2 and BeO targets. The resultant gamma ray spectra were measured with a high-purity germanium semiconductor detector at 70, 90, 110, 125, and 140 degrees relative to the direction of the incident beam for each proton energy. Other gamma ray lines resulting from direct excitation and spallation reactions with C-12 and 0-16 were observed as well, and their gamma ray production cross sections described.

10136 (UCRL—95416) Relativistic (3+1) dimensional hydrodynamic simulations of compact interacting binary systems. Mathews, G.J.; Evans, C.R.; Wilson, J.R. (Lawrence Livermore National Lab., CA (USA)). Sep 1986. Contract W-7405-ENG-48. 10p. (CONF-860793—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87000602.

From 2. IAP recontre on nuclear astrophysics; Paris, France (7 Jul 1986).

We discuss the development of a relativistic hydrodynamic code for describing the evolution of astrophysical systems in three spatial dimensions. The application of this code to several test problems is presented. Preliminary results from the simulation of the dynamics of accreting binary white dwarf and neutron star systems are discussed. 14 refs., 4 figs.

10137 (UCRL—95417) Primordial nucleosynthesis in inhomogeneous cosmologies: $\Omega = 1$ with baryonic dark matter. Mathews, G.J.; Sale, K.E. (Lawrence Livermore National Lab., CA (USA)). Sep 1986. Contract W-7405-ENG-48. 9p. (CONF-860793—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003250.

From 2. IAP recontre on nuclear astrophysics; Paris, France (7 Jul 1986).

We consider the constraints on Ω from primordial nucleosynthesis in inhomogeneous cosmologies. We find that allowance for isothermal fluctuations significantly weakens the upper bound on the average value of Ω derived from the standard big bang. Under the plausible additional assumption that regions of high baryon density are preferentially absorbed into cold dark matter, the constraints from primordial nucleosynthesis can be satisfied for large values of Ω, including $\Omega = 1$. 22 refs., 2 figs.

10138 Parallel electric fields in extragalactic jets - double layers and anomalous resistivity in symbiotic relationships. Borovsky, J.E. (Los Alamos National Lab., NM). *Astrophysical Journal;* **306**: 451-465(Jul 1986).

After examining the properties of Coulomb-collision resistivity, anomalous (collective) resistivity, and double layers, a hybrid anomalous-resistivity/double-layer model is introduced. In this model, beam-driven waves on both sides of a double layer provide electrostatic plasma-wave turbulence that greatly reduces the mobility of charged particles. These regions then act to hold open a density cavity within which the double layer resides. In the double layer, electrical energy is dissipated with 100 percent efficiency into high-energy particles, creating conditions optimal for the collective emission of polarized radio waves. 102 references.

10139 Temperature diagnostic line ratios of Fe XVII. Raymond, J.C.; Smith, B.W. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA; Los Alamos National Lab., NM). *Astrophysical Journal;* **306**: 762-766(Jul 1986).

Based on extensive calculations of the excitation rates of Fe XVII, four temperature-sensitive line ratios are investigated, paying special attention to the contribution of resonances to the excitation rates and to the contributions of dielectronic recombination satellites to the observed line intensities. The predictions are compared to FPCS observations of Puppis A and to Solar Maximum Mission (SMM) and SOLEX observations of the sun. Temperature-sensitive line ratios are also computed for emitting gas covering a broad temperature range. It is found that each ratio yields a differently weighted average for the temperature and that this accounts for some apparent discrepancies between the theoretical ratios and solar observations. The effects of this weighting on the Fe XVII temperature diagnostics and on the analogous Fe XXIV/Fe XXV satellite line temperature diagnostics are discussed. 27 references.

10140 Bimodal quasi-oscillatory and spectral behavior in Scorpius X-1. Priedhorsky, W.; Hasinger, G.; Lewin, W.H.G.; Middleditch, J.; Parmar, A. (Los Alamos National Lab., NM; Max-Planck-Institut fuer extraterrestrische Physik, Garching, West Germany; MIT, Cambridge, MA; EXOSAT Observatory, Darmstadt, West Germany). *Astrophysical Journal;* **306**: L91-L95(Jul 1986).

Exosat observations of Sco X-1 obtained using the Xe and/or Ar detectors for a total of about 80,000 s during four runs on August 24-27, 1985 are reported and analyzed. Two modes of quasi-periodic oscillations (QPOs) corresponding to the quiescent and active states of Sco X-1 and to two modes of spectral behavior are identified and characterized, confirming the findings of Priedhorsky (1985) and Middleditch and Priedhorsky (1986). In the quiescent state, the QPO frequency is about 6 Hz and is anticorrelated with intensity, and the spectral hardness ratio (14-21 vs 2-7 keV) varies steeply with intensity; in the active state, QPO frequency is correlated with intensity and varies from 10 to 20 Hz, and the spectral-hardness-ratio/intensity curve is flatter. Previous observations of bimodal behavior in other bands are summarized, and theoretical models proposed to explain them are discussed. 20 references.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 9621

10141 **(AD-A—172118/2/XAB) Plasma densities and irregularities at 830 km altitude based on observations during 1979. Interim report.** Rich, F.J.; Smiddy. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 28 May 1986. 37p. (AFGL-TR—86-0121). NTIS, PC A03/MF A01.

The in situ density of the thermal plasma was observed with instruments on two satellites of the Defense Meteorological Satellite Program. Each satellite was in a sun-synchronous polar orbit so that the two satellites surveyed the topside ionosphere in the mid-morning (7 to 11 hrs magnetic local time) and evening (19 to 23 hrs magnetic local time) sectors. This report presents a survey of the measured thermal ion density in order to determine the median plasma density at 830 km altitude observed as a function of latitude, longitude and season. These results are compared with plasma densities from standard models of the ionosphere, and from previous topside plasma-density observations. This report also presents a survey of low- and mid-latitude regions where plasma-density irregularities are found. The plasma-density irregularities in the equatorial region are presented as functions of latitude, longitude, and seasons. These regions are probably co-located with regions of Equatorial Spread F radio disturbances.

10142 **(AD-A—172178/6/XAB) Space radiation dosimeter SSJ* for the block 5D/Flight 7 DMSP (Defense Meteorological Satellite Program) satellite: calibration & data presentation. Environmental research papers.** Gussenhoven, M.S.; Filz, R.C.; Lynch, K.A.; Mullen, E.G.; Hanser, F.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 20 Mar 1986. 547p. (AFGL-TR—86-0065). NTIS, PC A23/MF A01.

The DMSP/F7 satellite carries, in addition to weather-monitoring devices, a number of instruments that measure the space environment for the purpose of scientific study. These are an auroral imaging device, precipitating-electron and -ion detectors, a thermal-plasma analyzer, a fluxgate magnetometer, and a space-radiation dosimeter. Together, these provide a strong tool for analyzing the high-latitude, near-Earth, magnetospheric environment. This report was prepared to facilitate the use of the data from one of these instruments, the space-radiation dosimeter, and to show the data can be used to obtain both dose and flux measurements of high-energy relativtic electrons and protons at low altitudes. The report includes: a description of the DMSP/F7 orbit; a description of the space-radiation dosimeter and the data it returns; the method by which dose is determined; the method by which flux is determined; and a discussion of the use of high-threshold-energy proton- and ion-induced star counts. Appendices A and B present the response of the dosimeter to electron bremsstrahlung and a list of the interactive routines available at AFGL for data analysis.

10143 **(AD-A—172208/1/XAB) Auroral implications of recent measurements on O(1S) and O(1D) formation in the reaction of N^+ with O_2.** Langford, A.O.; Bierbaum, V.M.; Leone, S.R. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). 1985. 5p. NTIS, PC A02/MF A01.

Recent flowing afterglow measurements have shown that the reaction of N(+) with O_2 produces 70 + or - 30% of the oxygen atom product as 0(1D) and <0.1% as 0(1S). These results indicate that this reaction does not contribute to the auroral green line emission (5577 A), but can account for about 10% of the observed red-line (6300 A) auroral emission.

10144 **(AD-A—172211/5/XAB) 250 MHz/GHz scintillation parameters in the equatorial, polar, and auroral environments. Environmental research papers.** Basu; MacKenzie, E.; Basu; Costa, E.; Fougere, P.F. (Emmanuel Coll., Boston, MA (USA)). 28 Mar 1986. 36p. NTIS, PC A03/MF A01.

Ionospheric scintillation effects encountered in the equatorial-anomaly crest, polar-cap, and auroral regions have been contrasted to provide information for the design and evaluation of the performance of satellite communication links in these regions. The equatorial-anomaly region is identified as the most-disturbed irregularity environment where the amplitude and phase structures of VHF/L-band scintillations are primarily dictated by the strength of scattering rather than ionospheric motion. In the anomaly region, the spectra of intense amplitude scintillations at VHF and L-band are characterized by uniform power spectral density from the lowest frequency (10 MHz) to 4 Hz at VHF and to 1 Hz at L-band and steep rolloff at higher fluctuation frequencies with power law indices of -5 to 07. Such structures are compatible with intensity decorrelation times of 0.1 and 0.3 sec at VHF and L-band frequencies, respectively. The phase spectra are described by power-law variation of psd with frequency with typical spectral indices of -2. 4. The strong scattering at VHF induces extreme phase rates of 200 deg. in 0.1 sec. The 90th percentile values of rms phase deviation at 250 MHz with 100-sec detrend are found to be 16 rads in the early evening hours whereas amplitude scintillation can cover the entire dynamic range of 30 dB not only at 250 MHz but at L-band as well.

10145 **(AD-A—172249/5/XAB) Sondrestrom radar observations of the effect of the IMF by component on polar convection.** de la Beaujardiere; Wickwar, V.B.; King, J.H. (SRI International, Menlo Park, CA (USA)). 1985. 14p. NTIS, PC A02/MF A01.

Average patterns of convection, derived from Sondrestrom radar observations, reveal that the interplanetary magnetic field dawn-dusk component (IMF By) strongly influences the nighttime polar convection. The convection for one orientation of By is not the mirror image of the other orientation. A positive By seems to organize the velocities such that, at all local times, they are predominantly westward within the radar latitude range. On a case-by-case basis, auroral oval boundaries can be determined by coincident DMSP particle data and by radar-measured E-region densities. On one occasion of positive By, sunward flow (i.e., westward flow) is observed in the polar cap between dusk and midnight. For large negative By, large southward velocities are observed about three hours before midnight. These are the only times when the predominant velocity component is clearly southward. When By is negative, in the midnight and dawn sectors, the plasma velocities appear random. However, the average drifts are mostly southward. The radar average patterns are compared with theoretical predictions.

10146 **(AD-A—172474/9/XAB) High-latitude ionospheric irregularities. Final report, 1 March 1983-30 May 1986.** Vickrey, J.F. (SRI International, Menlo Park, CA (USA)). Jul 1986. 9p. NTIS, PC A02/MF A01.

A brief summary of some of key results involving the production, transport, and ultimate decay of naturally occurring ionospheric plasma structure.

10147 **(DOE/ER/70005—4) A study of magnetic field annihilation and aurora-induced currents in a power transition line and in the Trans-Alaskan pipeline: Final technical report.** Akasofu, S.I.; Lee, L.C. (Alaska Univ., Fairbanks (USA). Geophysical Inst.). Oct 1986. Contract AT06-76ER70005. 78p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003135.

Progress is reported for two research projects. The first research project is to learn how the magnetic field annihilation processes occur under magnetospheric, solar, and astrophysical conditions. The second project studies energy-related problems in the arctic regions which arise from auroral effects. These auroral effects include induced electrical current in powerline systems and the Trans-Alaska pipeline and the use of both man-made and natural electromagnetic waves in sounding permafrost, one of the most serious problems in extracting and transporting crude oil. 43 refs., 25 figs.

10148 **(N—86-32289) Space plasma research. Quarterly progress report, April-June 1986.** Comfort, R.H.; Horwitz, J.L. (Alabama Univ., Huntsville (USA)). Jul 1986. 14p. (NASA-CR—178898; NAS—1.26:178898). NTIS HC A02/MF A01.

Temperature and density analysis in the Automated Analysis Program (for the global empirical model) were modified to use flow velocities produced by the flow velocity analysis. Revisions were started to construct an interactive version of the technique for temperature and density analysis used in the automated analysis program. A sutdy of ion and electron heating at high altitudes in the outer plasmasphere was initiated. Also the analysis of the electron gun experiments on SCATHA were extended to include eclipse operations in order to test a hypothesis that there are interactions between the 50 to 100 eV beam and spacecraft generated photoelectrons. The MASSCOMP software to be used in taking and displaying data in the two-ion plasma experiment was tested and is now working satisfactorily. Papers published during the report period are listed.

10149 **Radio wave diffraction during the passage of an acoustic shock through a sporadic E layer.** Jacobson, A.R.; Carlos, R.C.; Argo, P.E.; Rickel, D.G. (Los Alamos National Lab., NM). *Radio Science;* 21: 752-760(Aug 1986).

Bistatic HF Doppler measurements of the ionospheric disturbance arising from a large ground-level chemical explosion have revealed a peculiar HF return which begins at large positive Doppler (greater than +5 Hz) and linearly evolves to large negative Doppler (less than -5 Hz). Various pieces of evidence in the data suggest that an HF wave which is diffracted from the intersection of the acoustic shock and an extensive plane of sporadic E ionization at 110 km was observed. From these measurements the horizontal trace velocity of the locus of intersection is estimated. 16 references.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 9374, 9430, 9449, 9454, 9537, 9538, 9603, 9659, 9776, 10534

10150 **(CONF-861114—30) Measured multipole moments of continuum electron transfer angular distributions.** Elston, S.B. (Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy; Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003007.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

The velocity space distribution of electrons emitted near the forward direction from collisions involving fast, highly stripped oxygen ions with gaseous and solid targets is presented and described in terms of multipole moments of the ejected charge distribution, which permits direct comparison with recent theory. The measurements are produced by employing position-sensitive electron detection to combine emission angle definition with conventional electrostatic spectrometry. Agreement obtained between theory and distributions observed for binary continuum electron loss processes coupled with a similar multipole content observed with solid targets suggests a model of convoy electron production dominated by electron loss from the projectile within the bulk of the target. Further, the connection between multipoles of the projectile electron emission distribution in single collisions and the state of excitation of that projectile excited states may provide the basis for a probe of the state of ions traversing bulk solid matter. 14 refs., 3 figs., 1 tab.

10151 **(CONF-8411153—6) Energy transfer and isotopic enrichment in vibrationally pumped diatomic molecules.** DeLeon, R.L.; Rich, J.W.; Bergman, R.C.; Homicz, G.F. (Calspan Advanced Technology Center, Buffalo, NY (USA)). 1984. Contract AC02-83ER13115. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002003.

From International conference on lasers '84; San Francisco, CA, USA (26 Nov 1984).

The preliminary results from two experiments on vibration-vibration pumped CO are reported. The first experiment is a demonstration of isotopic enrichment by vibration-vibration pumping. An ~300°K translational temperature flowing mixture of CO, Ar and He is excited by a CO laser and the resulting non-equilibrium vibrational distribution is probed by laser induced fluorescence. In CO plus Ar mixtures, ^{13}CO enrichments of a factor of three times the natural ^{13}CO abundance are observed for high, v = 30, vibrational states. In CO plus Ar and He mixtures the ^{13}CO enrichment is reduced to approximately its natural abundance. Calculations indicate that larger He mole fractions could result in relative enrichment of the ^{13}CO isotope. The second experiment is a time and state resolved kinetics study of vibration-vibration pumped CO. A pulsed CO laser is used to produce a highly excited vibrational distribution. The vibrationally resolved overtone emission from the ground electronic state is monitored as a function of time for states v = 2 to 40. Electronic emission from the A-X band is also observed. In order to derive the kinetic rates for the various vibrational exchange processes, the data are compared with a kinetic model including all of the energy exchange terms. Preliminary calculations show reasonable agreement with the observed ground electronic state emission. 10 refs., 4 figs.

10152 **(DOE/ER/04936—T2) Nuclear structure of light thallium isotopes as deduced from laser spectroscopy on a fast atom beam.** Bounds, J.A. (Oak Ridge Associated Universities, Inc., TN (USA)). Aug 1985. Contract AS05-76ER04936;AC05-76OR00033. 112p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86014193.

Thesis submitted to the Univ. of Tennessee, Knoxville.

After optimizing the system by experiments on /sup 201,203,205/Tl, the neutron-deficient isotopes $^{189-193}$Tl have been studied using the collinear fast atom beam laser spectroscopy system at UNISOR on-line to the Holifield Heavy Ion Research Facility. A sensitive system for the measurements was developed since the light isotopes were available in mass-separated beams of only 7 x 10^4 to 4 x 10^5 atoms per second. By laser excitation of the 535 nm atomic transitions of atoms in the beam, the $6s^2 7s$ ^{2}S/sub 1/2/ and $6s^2 6s$ ^{2}P/sub 3/2/ hyperfine structures were measured, as were the isotope shifts of the 535 nm transitions. From these, the magnetic dipole moments, spectroscopic quadrupole moments and isotopic changes in mean-square charge radius were deduced. The magnetic dipole moments are consistent with previous data. The /sup 190,192/Tl isotopes show a considerable difference in quadrupole deformations as well as an anomalous isotope shift with respect to ^{194}Tl. A large isomer shift in ^{193}Tl is observed implying a larger deformation in the $9/2^-$ isomer than in the $1/2^+$ ground state. The /sup 189,191,193/Tl isomers show increasing deformation away from stability. A deformed shell model calculation indicates that this increase in deformation can account for the dropping of the $9/2^-$ band in these isotopes while an increase in neutron pairing correlations, having opposite and compensating effects on the rotational moment of inertia, maintains the $9/2^-$ strong-coupled band structure. 105 refs., 27 figs.

10153 **(DOE/ER/10635—4) The glow discharge as an atomization and ionization device: Progress report, November 1, 1983-November 1, 1984.** Harrison, W.W. (Virginia Univ., Charlottesville (USA). Dept. of Chemistry). 1984. Contract AS05-80ER10635. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002720.

This progress report describes research which has been completed over the past 12 months of this project. We report here representative examples of the work carried out; reprints and preprints may be referred to for more complete details and documentation. Progress has been concentrated in two main areas: (1) laser resonance ionization mass spectrometry and (2) the hollow cathode plume as an emission and ionization source.

10154 **(GSI—86-17) Resonant electron transfer and L-shell excitation at 3.6 MeV/u ^{62}Sm/sup q+/ -> Xe collisions, q=35-52.** Schoenfeldt, W.A.; Mokler, P.H.; Hoffmann, D.H.H.; Warczak, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1986. 50p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750305.

For 3.6 MeV/u Sm/sup q+/ projectiles a hump in the projectile (L/sub l/+L/sub α/) X-ray emission cross section is seen as a function of charge state q for high q with 46<=q<=52 (closed incoming L-shell). This hump is mainly attributed to the Resonant electron Transfer from the Xe target atom with simultaneous Excitation of an L_{α}-shell electron to the M-shell. The cross section for this L_{α}-shell RTE process gives values of up to 2 . 10^{-19} cm^2 which is seen in single spectra already. To demonstrate the strong existence of the L-shell RTE process for the studied collision system, extensive calculations have been carried out. This concerns especially the L_a-shell fluorescence yields for the radiative stabilization process in the highly charged projectile, when simultaneous transfer and excitation has taken place. Our calculated q-dependent cross sections for the RTE process support the given interpretation.

10155 (GSI—86-24-Prepr.) **Physics of strong fields.** Soff, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1986. 12p. (CONF-8606130—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750306.

From International conference on nuclear structure, reactions, and symmetries; Dubrovnik, Yugoslavia (5 Jun 1986).

Selected topics are presented which have been extensively discussed at the parallel conference 'Physics of Strong Fields' in Maratea (Italy). Special emphasis is laid on the origin of puzzling peak structures in positron spectra being observed in collisions of very heavy ions. Additionally it is demonstrated that the spectral distribution of high-energy electrons and positrons may serve as an accurate atomic clock to determine the time delay associated with deep-inelastic nuclear reactions.

10156 (INIS-mf—10512, pp 31) **Hyperfine structure and isotope shift of the K-D_2 line.** Windholz, L.; Pfeifer, G. (Technische Univ., Graz, Austria). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10157 (INIS-mf—10512, pp 31) **Calculations of the Stark effect in neon atoms.** Ziegelbecker, R.; Windholz, L. (Technische Univ., Graz, Austria). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10158 (INIS-mf—10512, pp 26) **Inversion of elastic scattering phases for the heavy ion scattering.** Leeb, H.; Fiedeldey, H.; Lipperheide, R. (Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik; South Africa Univ., Pretoria; Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H., Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10159 (INIS-mf—10512, pp 28) **Translation energy spectroscopy in collisions of doubly charged noble gas ions with lithium.** Jellen-Wutte, U.; Krammer, M.; Schweinzer, J.; Vanek, W.; Winter, H. (Technische Univ., Vienna, Austria. Inst. fuer Allgemeine Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10160 (INIS-mf—10512, pp 28) **Target excitation and electron capture in collisions of singly charged ions of 2-20 keV with Li(2s) and Na(3s).** Lakits, G.; Jangg, B.; Winter, H. (Technische Univ., Vienna, Austria. Inst. fuer Allgemeine Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10161 (INIS-mf—10512, pp 97) **Interaction of slow highly charged ions with solid surfaces.** Varga, P. (Technische Univ., Vienna, Austria. Inst. fuer Allgemeine Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10162 (LA-UR—86-4052) **Application of a laser-induced breakdown time-of-flight technique in a flow diagnostic in a CO_2 free-jet expansion.** Wantuck, P.J.; Hof, D.E. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 4p. (CONF-861038—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002890.

From OSA/APS international laser science conference; Seattle, WA, USA (20 Oct 1986).

A time-of-flight velocity technique utilizing ions formed by the process of laser-induced (1.064 μm) breakdown has been used to measure axial flow speeds in a CO_2 free-jet expansion. For the nozzle stagnation pressure and temperature employed (p0 ≅ 200 torr, T0 ≅ 298K), the axial flow speed is on the order of 630 m/s. 5 refs., 3 figs., 1 tab.

10163 (LBL—21999) **Multiply stripped ion generation in the metal vapor vacuum arc.** Brown, I.G.; Feinberg, B.; Galvin, J.E. (Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003629.

We consider the charge state distribution of ions produced in the metal vapor vacuum arc plasma discharge. A high current metal ion source, the MEVVA ion source, in which the ion beam is extracted from a metal vapor vacuum arc plasma, has been used to obtain the spectra of multiple charged ions produced within the cathode spots. A computer calculation of the charge state distribution that evolves within the spots via stepwide ionization of ions by electron impact provides a theoretical basis for comparison of the data. In this paper we report on the measured charge state distributions for a wide variety of metallic species and compare these results with the predictions of this theory. 55 refs.

10164 (NBSIR—86-3431) **X-ray attenuation coefficients (total cross sections): Comparison of the experimental data base with the recommended values of Henke and the theoretical values of Scofield for energies between 0.1-100 keV.** Saloman, E.B.; Hubbell, J.H. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Jul 1986. 714p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE87003057.

A comparison is carried out, in both graphical and tabular form, over the energy range 0.1 to 100 keV between the National Bureau of Standards' data base of experimental x-ray attenuation coefficients (total absorption cross sections) and cross sections obtained using two sets of photoionization cross section values: the semi-empirical set of recommended values produced by Henke et al. which covers the energy range .03 to 10 keV; and a theoretical set calculated by Scofield which covered the range 1 to 1500 keV and was extended by Scofield, at our request, to also cover the 0.1 to 1 keV range. There has been some disagreement over whether Scofield's results should be subject to renormalization from a Hartree-Slater to a Hartree-Fock atomic model. Therefore in the tables a comparison is made of Scofield's predictions both with and without this renormalization. 10 refs.

10165 **Electron drift velocity and attachment and ionization coefficients for gases/mixtures for use in diffuse discharge switching applications.** Hunter, S.R.; Christophorou, L.G.; Carter, J.G. (Atomic, Molecular and High Voltage Physics Group, Health and Safety Research Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 7 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—). Contract AC05-84OR21400.

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

Several gas mixtures have recently been discovered which have near-ideal electron conduction and insulating properties in e-beam controlled diffuse gas discharge opening switches. Under repetitive switching conditions, the temperature of the switch is expected to rise several degrees at each operation and long-term temperature increases of several hundred degrees centigrade are likely. The electron transport and rate coefficients are expected to be functions of the gas temperature T, and consequently, knowledge of these parameters as a function of T is desirable for modeling the operation of the diffuse discharge switch in practical applications. Measurements of the electron drift velocity and attachment and ionization coefficients have been made in C/sub 2/F/sub 6//Ar and C/sub 2/F/sub 6//CH/sub 4/ gas mixtures at gas temperatures of 300, 500, and 700 K over the concentration range of 0.1 to 100% of the C/sub 2/F/sub 6/. The electron ionization coefficient in C/sub 2/F/sub 6/ is unchanged by increases in T, whereas the attachment coefficient increases significantly with T for all concentrations of C/sub 2/F/sub 6/ in either Ar or CH/sub 4/. The greatest increases in electron attachment with increasing T occur near the threshold of the attachment coefficients in gas mixtures with low C/sub 2/F/sub 6/ concentrations, and the rate of increase decreases with increasing C/sub 2/F/sub 6/ concentration. This finding is believed to be the result of changes in the electron energy distribution function with increasing C/sub 2/F/sub 6/ concentration rather than actual changes in the electron attachment processes to C/sub 2/F/sub 6/.

10166 **Vacuum ultraviolet refractive-index measurement in xenon.** Kramer, S.D.; Payne, M.G.; Chen, C.H. (Oak Ridge National Lab., Chemical Physics Section, P.O. Box X, Oak Ridge, TN). pp 154 of Conference record of the 1985 IEEE conference on lasers and electro-optics. Piscataway, NJ; IEEE Service Center (1985). (CONF-850558—).

From Conference on lasers and electro-optics; Baltimore, MD, USA (21 May 1985).

Although the refractive index is an important atomic property, few accurate index measurements for inert gases in the VUV region above the first allowed transition have been made. This report describes the first measurement of the refractive index of Xe gas in the negatively dispersive region from $\approx$115 to 117 nm.

10167 **Introduction to fundamental interactions in atomic collisions.** Merzbacher, E. (Univ. of North Carolina, Chapel Hill, NC). pp 31-49 of Fundamental processes in atomic collision physics. Kleinpoppen, H.; Briggs, J.S.; Lutz, H.O. New York, NY; Plenum Press (1985). (CONF-8409181—).

From NATO advanced study institute on fundamental and technological aspects of Organo-F-Element chemistry; Acquafredda di Maratea, Italy (10 Sep 1984).

This paper describes collision processes intentionally formulated in terms to encompass the interactions of particles, photons, and composite systems, as they make their appearance in nonradiative and radiative atomic and molecular collision processes. Decay processes are examined as "half-collision", and the connection between the T matrix and decay rates are established. The results are expressed in terms of the density matrix as the most convenient tool for an analysis of experiments. The specific interactions which govern the dynamical processes of atomic physics are studied.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 10655

10168 **(LA-UR—86-3844) A collective coordinate method for classical dynamics of nonlinear Klein-Gordon kinks.** Flesch, R.J.; Trullinger, S.E.; Horovitz, B. (Los Alamos National Lab., NM (USA); University of Southern California, Los Angeles (USA). Dept. of Physics; Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics). 1986. Contract W-7405-ENG-36. 6p. (CONF-8605199—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002909.

From 6. CNLS annual conference on nonlinearities in condensed matter; Los Alamos, NM, USA (4 May 1986).

A collective coordinate method is used to study the motion of a nonliear Klein-Gordon (NKG) kink in the presence of a weak, localized perturbation. An equation of motion is derived for the kink "center of mass" position which includes the effects of phonons. A perturbation expansion of these equations shows that through second order, no extended phonons are generated by the "collision" of the kink with a static perturbation. As a consequence, the kink recovers its initial velocity after passing through the perturbation region. 11 refs., 3 figs.

10169 **(UCID—20938) The response of a turbulent boundary layer to a small-amplitude traveling wave.** Howes, F.A. (Lawrence Livermore National Lab., CA (USA)). 4 Dec 1986. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003609.

We study the response of a turbulent boundary layer to an outer-flow disturbance in the form of a small-amplitude wave travelling along the bottom of a smooth channel. In a previous paper we proposed a model for the viscous attenuation of a wave propagating along the interface between two superposed fluids inside a laminar boundary layer attached to the bottom wall. We obtained precise estimates on the amount of attenuation suffered by the oscillatory component of the motion as a result of viscous dissipation. This was accomplished by means of a representation of the solution as the asymptotic sum of a Blasius boundary layer profile and a modified Stokes layer profile. The present paper contains a similar asymptotic decomposition of the solution of the appropriate turbulent Prandtl equations when the outer flow is a small-amplitude travelling wave, and so it may be considered an extension of our previous work to the more realistic case of turbulent flow. 4 refs.

10170 **Diffusion-synthetic acceleration of transport iterations, with application to a radiation hydrodynamics problem.** Alcouffe, R.E.; Clark, B.A.; Larsen, E.W. pp 73-111 of Multiple time scales. Brackbill, J.U.; Cohen, B.I. Orlando, FL; Academic Press, Inc. (1985).

New numerical methods for solving time-dependent radiative transfer problems in emitting media are described. Three aspects of the solution methods are treated in detail: the time dependence, the intimate coupling between the radiation field and the medium, and the iteration acceleration of the equation of transfer. Iterative procedures for solving the equation of transfer, to which terms from the energy balance equation have been adjoined, are first described, followed by a specific problem in radiative hydrodynamics. The effect of the choice of time steps and iteration convergence on solution accuracy is discussed. 11 references.

6450 High Energy Physics

10171 **(KEK—84-14) Proceedings of the 1984 ICFA seminar on 'future perspectives in high energy physics'.** Ozaki, Satoshi; Kurokawa, S.; Unno, Y. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan); European Organization for Nuclear Research, Geneva (Switzerland)). Sep 1984. 378p. (CONF-8405218—). NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049.

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

Individual papers in these seminar proceedings are abstracted individually.

10172 **(KEK—85-5) Proceedings of the international symposium on physics of proton-antiproton collision.** Shimizu, Y.; Takikawa, K. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan); Tokushima Univ. (Japan)). Aug 1985. 584p. (CONF-8503151—). NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046.

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Individual papers in these symposium proceedings are abstracted separately.

10173 (KEK—85-6) **Proceedings of the workshop on future plans for high energy physics.** Iwata, Seigi; Kondo, Takaniko (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan); Yamanashi Univ., Kofu (Japan). Faculty of Engineering). Aug 1985. 384p. (CONF-8503265—). NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047.

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

Individual papers in these workshop proceedings are abstracted separately.

10174 (LBL—19173) **A user's guide to particle physics computer-searchable databases on the SLAC-SPIRES system.** Rittenberg, A.; Armstrong, F.E.; Levine, B.S.; Trippe, T.G.; Wohl, C.G.; Yost, G.P.; Whalley, M.R.; Addis, L. (Lawrence Berkeley Lab., CA (USA); Durham Univ. (UK). Dept. of Physics; Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1986. Contract AC03-76SF00098. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003634.

This report discusses five computer-searchable databases located at SLAC which are of interest to particle physicists. These databases assist the user in literature-searching, provide numerical data extracted from papers, and contain information about experiments. We describe the databases briefly, tell how to use the SPIRES database management system to access them interactively, and give several examples of their use.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 9759, 9760, 9848, 10263, 10307, 10307, 10329, 10338

10175 (ANL-HEP-CP—86-94) **Particle production in e^+e^- annihilation at 29 GeV.** Derrick, M. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 17p. (CONF-8606203—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001555.

From Symposium on multiparticle dynamics; Seewinkel, Austria (13 Jun 1986).

Recent results on particle production in e^+e^- annihilation at 29 GeV are reviewed. The data were obtained using the High Resolution Spectrometer at PEP and correspond to an integrated luminosity of 300 pb^{-1}. The mean charged particle multiplicity in gluon jets from the three-jet events is found not to differ from that measured for quark jets. The production of the scalar meson S(975) and the tensor mesons $f^0(1270)$ and $K^*(1430)$ are observed and the rates are compared to the previously observed vector mesons, rho and $K^*(890)$. Finally, some of the global properties of charged particle production are presented and compared with similar results from soft hadronic collisions. 16 refs., 7 figs.

10176 (CERN-EP—86-142) **Jet physics and QCD [quantum chromodynamics] tests in the UA1 experiment at the CERN proton-antiproton collider.** Ceradini, F. (Rome Univ. (Italy). Dipartimento di Fisica; European Organization for Nuclear Research, Geneva (Switzerland)). 29 Sep 1986. 9p. (CONF-860701—53). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900143.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

This is a brief review of the results of the UA1 Collaboration for jet physics at the CERN proton-antiproton Collider. Data on inclusive jet production and on two- and three-jet production are confronted with perturbative QCD predictions.

10177 (EFI—820(47)-85) **Investigation of incoherent production of pion systems in $\pi p A \to \pi^- \pi^- A'$ and $\pi^- A \to \pi^- \pi^- \pi^+ A'$ reactions on nuclei at 5 GeV/c.** Agababyan, N.M.; Atayan, M.R.; Grigoryan, Zh.B. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1985. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700204.

On the basis of processing the photographs taken from the 1 m propan-freon bubble chamber (Laboratory of Nuclear Problems, JINR irradiated with approximately 5 GeV/c π^--mesons on the JIR synchrophasotron, there are measured cross sections and investigated some characteristics of incoherent reactions $\pi^- A \to \pi^- \pi N$ $^- A'$ (on carbon nucleus and propan-freon muxture nuclei) and $\pi^- A \to \pi^-$ rho deg A' (on propan-freon mixture nuclei), which satisfy a kinematics of single-nucleon reactions. From the comparison with nucleon data, the cross sections of interaction of non-resonant dimeson systems ($\pi^- \pi^-$) and (π^- rho deg) with nucleon are estimated. A conclusion is made that mesons with momenta up to some GeV/c are formed inside nucleus. 17 refs.; 11 figs.

10178 (FNAL/C—86/115) **Anti pp searches for quark-gluon plasma at TeV I.** Turkot, F. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1986. Contract AC02-76CH03000. 14p. (CONF-8604282—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002077.

From Quark matter '86; Asilomar, CA, USA (1 Apr 1986).

Three experiments that have been approved to run at TeV I are discussed from the viewpoint of their capability to search for evidence of the QCD phase transition in proton-antiproton collisions at 1.6 TeV. One of these experiments, E-735, was proposed as a dedicated search for quark-gluon plasma effects with a detector designed to study large total E/sub T/, low P/sub T/ individual particles. The other two, E-741 (CDF) and E-740 (DO), embody general purpose four-pi detectors designed primarily to study the physics of W and Z bosons and other large P/sub T/ phenomena. The detectors and their quark-gluon plasma signals are compared. 8 refs., 6 figs., 4 tabs. (LEW)

10179 (INIS-mf—10512, pp 86) **Physics with the DELPHI detector at the CERN LEP storage ring .** Adam; Bartl; Fruewirth. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10180 (INIS-mf—10512, pp 87) **New results of the ASTERIX experiment at LEAR, CERN.** Laa, C. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10181 (INIS-mf—10512, pp 25) **Physics with the LEP accelerator.** Dydak, F. (European Organization for Nuclear Research, Geneva, Switzerland). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10182 (INIS-mf—10512, pp 87) **Measurement of heavy quarks production with the UA-1 detector at the CERN SPS antiproton-proton storage ring.** Strauss, J. (Inst. fuer Hochenergiephysik, Wien, Austria). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10183 (IPNO-TH—85-47) **Comparison of proton-proton and proton-antiproton scattering at very high energies.** Gauron, P.; Nicolescu, B.; Leader, E. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Sep 1985. 13p. (CONF-8506197—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750778.

From Workshop on elastic and diffractive scattering at the collider; Chateau de Blois, France (3 Jun 1985).

The ISR results on the differential cross-sections for pp and anti-pp show unambiguously that the crossing-odd amplitude is still important at very high energies. Comparison of ISR and CERN collider anti-pp data suggests that the crossing-odd amplitude is growing maximally fast with energy. We explore the phenomenological consequences of such a "maximal odderon" behaviour at TeV energies.

10184 (IS-T—1249) **Search for gluonic bound states in high energy proton-proton collisions.** Isenhower, L.D. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87003052.

The Double Pomeron Exchange process is studied as a potential source for the production of gluonic bound states utilizing the Intersecting Storage Rings at the European Organization for Nuclear Research in Geneva, Switzerland. Three different triggers are studied, which differ in the requirements placed on the slow central system produced by the Pomeron-Pomeron interaction. Exclusive four and six prong events are studied. A spin-parity analysis is performed on the $\pi^+\pi^-$ system in the exclusive channel pp $\rightarrow$ pp$\pi^+\pi^-$ for two of the triggers. The large enhancement previously seen in DPE reactions in the region of the f^0 meson is confirmed to be a spin-two object. No other resonant states are observed in the $\pi^+\pi^-$ system. The exclusive channels pp $\rightarrow$ ppK^+K^- and pp $\rightarrow$ ppp anti p are examined, but due to limited statistics no strong conclusions can be drawn from these samples. The exclusive channel pp $\rightarrow$ pp$\pi^+\pi^+\pi^-\pi^-$ is analyzed for the subprocesses pp $\rightarrow$ pprho^0 $\pi^+\pi^-$ and pp $\rightarrow$ pp rho^{0}rho^0. No enhancement is seen for the rho^{0}rho^0 channel. This result is quite different from that obtained for the topologically similar $\gamma\gamma$ interaction in e^+e^- collisions. A simple spin-parity analysis of the $\pi^+\pi^+\pi^-\pi^-$ system reveals no structure as a function of the four pion mass. The exclusive process pp $\rightarrow$ ppK/sub s/$^0K^{+-}\pi^{-+}$ is studied and the $K^0K\pi$ mass spectrum is examined. An enhancement is seen in the region of 1500 MeV, but it appears to originate from events which have missing tracks, rather than from the exclusive final state. While this does not preclude its interpretation as a genuine resonant state, it does mean that a definite statement cannot be made on the basis of this analysis.

10185 (KEK—84-14, pp 110-151) **Physics as a function of energy and luminosity.** Ellis, J. (European Organization for Nuclear Research, Geneva, Switzerland). Sep 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780049. (CONF-8405218—).

From ICFA seminar on future perspective in high energy physics; Tsukuba, Japan (14 May 1984).

In this paper, a new physics in the range of mass up to TeV region is discussed. Most of the discussion concern hadron-hadron (hh) colliders, and also electron-positron colliders are discussed. The cross-sections for new particle production in hh colliders have the general Drell-Yan form, in which the differential luminosity for the collision of partons is included. The formulas with the parton distribution scaled up from present energy using the Altarelli-Parisi equations may be approximately correct within a factor of 2 for the production of particles. Some typical parton-parton luminosity functions for proton-proton and proton-antiproton collisions are presented. From the consideration of luminosity, it can be said that the pp colliders are to be preferred. The case studies of some of the possible new physics discussed by Zakharov, mainly on Higgs bosons and supersymmetric particles, but also a few remarks about technicolor are presented. It seems possible to detect technicolor at a large hh collider. The physics reaches of different possible hh colliders are summarized in tables. In the tables, the observable production of Higgses up to 1 TeV in mass, the observable masses for gluinos (squarks) and the technicolor observability are shown. The cleanliness of electron-positron colliders compared to hadron-hadron colliders is pled, a guess is given as to the appropriate conversion factors between the energy in the electron-positron and hh collisions, the complementarity of electron-positron and hh colliders is urged, and it is argued that a rational mix of world accelerators would include both.

10186 (KEK—84-20, pp 337-352) **Search for right-handed currents in the kaon decay.** Yamanaka, Taku. (Tokyo Univ., Japan). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

The longitudinal polarization of the muon emitted in the decay $K^+ \rightarrow \mu^+\nu$ was measured to search for right-handed weak currents in the strangeness-changing process. The polarization was determined to be -0.970 +- 0.047, which is consistent with the V-A hypothesis.

10187 (KEK—84-20, pp 69-84) **Search for exotic mesons.** Nakamura, K. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Search for exotic mesons is an interesting program for KEK (National Laboratory for High Energy Physics) PS (proton synchrotron). In this context, a possibility is discussed that the recently observed structure in the cross sections of the reactions anti p p $\rightarrow$ $\pi^+\pi^-$ and K^+K^- at around 500 MeV/c is an exotic state. If the structure is interpreted as due to a meson resonance, its properties suggest that a hybrid meson or a glueball is a possible candidate for this resonance. If the resonance is confirmed and proved to be an exotic meson, a new possibility will be opened up for meson spectroscopy to be investigated at KEK PS. A KEK experiment E131 aims at confirming this resonance in anti p p $\rightarrow$ $\pi^+\pi^-$ and K^+K^- with higher statistics than the present experiment, and is scheduled to start in 1985.

10188 (KEK—84-20, pp 116-121) **Search for H dibaryon.** Sugimoto, Y. (Kyoto Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

An experiment to search for a dibaryon with the strangeness -2 called H is planned at the KEK (National Laboratory for High Energy Physics). This plan is briefly described. The H dibaryon consists of (u, u, d, d, s, s) quarks, all in S state. It has the strangeness S = -2, isospin I = 0 and spin-parity J sup(p) = 0^+. With He^3 as the target, it is possible to find the H dibaryon by observing the K^+ momentum spectrum if the π/K separation capability is adequate. The promising way to search for H dibaryon is to use the vertex detector with a carbon (or scintillator) target. If the decay vertex of H is detected, it will be an unambigous evidence for the existence of the H dibaryon.

10189 (KEK—84-20, pp 263-269) **Study of unstable nuclei via high-energy nuclear reactions. A general introduction to INS-LBL secondary beam experiments.** Takahashi, Noriaki. (Osaka Univ., Toyonaka, Japan. Coll. of General Education). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Beams of stable and unstable nuclei have been produced via fragmentation processes in the high-energy heavy-ion reactions. Total interaction cross sections have been measured in transmission experiments. Nuclear radii of unstable nuclei are determined by assuming that these nuclei are black spheres. Secondary nuclear reactions initiated by unstable nuclei have been observed. Scopes and outlooks are presented for the utilization of such unstable nuclear beams.

10190 (KEK—84-20, pp 245-260) **Critical appraisal of bound delta states.** Gugelot, P.C. (Tokyo Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Resonances attributed to Δ's bound in nuclei are analysed. The kinematics of the reactions can account for the enhancements of the observed cross sections.

10191 (KEK—84-20, pp 85-100) **Anti p p experiment and K4 beam line at KEK.** Takeutchi, Fujio. (Kyoto Sangyo Univ., Japan). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

An experiment on anti p p reaction at rest has been conducted at KEK (National Laboratory for High Energy Physics). Though the data taking were finished more than six months ago, the analysis is still being made. So, the final results and the physics involved cannot be discussed yet. The experimental procedure is mainly described as experiments using the new beam line K4. Attached to the C extraction line, the beam line features a large acceptance together with a two-stage separator. It is intended to publicize quality of this beam line and to encourage nuclear physicists to use the beam line and evenfually the spectrometer used in this experiment in future.

10192 (KEK—84-20, pp 101-115) **Meson spectroscopy experiment at KEK - E/iota puzzle.** Tsuru, Tsuneaki. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Physics interests at the KEK (National Laboratory for High Energy Physics) are (1) search for exotic mesons such as glueballs (gg), meiktons (q anti q g) and multiquark states (q sup(2^-)q^2), (2) search for missing ordinary mesons (q anti q) and confirmation of unestablished mesons, and (3) new informations of quark contents of mesons, mixing angles of SU(3) singlet-octet and tests of conservations law. Special interest is in search for exotics such as glueballs and meiktons. (2) is a so-called meson spectroscopy experiment. This is important not only in itself but also in identifying newly discovered states as exotics because exotics have often same quantum numbers as ordinary mesons. Contents are the following: glueballs and E/iota puzzles, spectrometer system, experiments, performance of the spectrometer, physics outputs, E/iota puzzles and πI experiment, future plans.

10193 (KEK—85-4, pp 17-40) **Next generation underground facility at Kamioka.** Koshiba, M.; Totsuka, Y. (Tokyo Univ., Japan. Faculty of Science). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

A brief outline of the next generation underground facility at Kamioka is described. A large water Cerenkov detector is specifically considered.

10194 (KEK—85-4, pp 111-122) **Test of W boson anomalous magnetic moment at SSC.** Matsuda, Satoshi. (Kyoto Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

We report our study on the possibility of detecting the W boson anomalous magnetic moment kappa at SSC. Estimates of the QCD induced background for the process $pp \rightarrow W\gamma + X$ at SSC energies indicate that although the process can probably be observed, it is unlikely to yield a precision measurement for the value of kappa.

10195 (KEK—85-4, pp 1-16) **Search for nucleon decay into charged lepton + mesons.** Arisaka, K.; Kajita, T.; Kifune, T. (Tokyo Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

The outline of the KAMIOKA Nucleon Decay Experiment (KAMIOKANDE) and some results of a search for nucleon decay into charged lepton modes are described. The KAMIOKANDE detector is located at 1000 m underground in the Kamioka mine, about 300 Km west of Tokyo. It is a large cylindrical volume of water (3000 tons) viewed by 1000 photomultipliers with 20″ photosensitive area. The great sensitivity of the detector makes it possible to clearly identify each Cherenkov ring produced by relativistic charged particles. The clean shape of Cherenkov rings suffices to give information on the direction and vertex position of the charged particles. Observations were made for 343 days of live time. Corresponding to 827 ton.years or 5.0 x 10^{32} nucleon.years. 10^3 fully contained events were found and their general characteristics can be well explained by ν interactions. Four events survived the tight kinematic cuts while the expected background is small. They are consistent with nucleon decay. However, taking the uncertainty in the background estimation into consideration, the selected events are not considered as strong evidence for nucleon decay. They are used only to obtain the lower limits on the nucleon lifetime/branching ratio for a number of possible decay modes.

10196 (KEK—85-5, pp 163-177) **W and Z production properties at the CERN SPC Collider.** Geer, S. Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The production properties of intermediate vector bosons produced at the CERN Super Proton Synchrotron (SPS) Collider are described. The longitudinal and transverse momentum distributions, and the properties of the hadronic jet activity produced in association with the intermediate vector bosons, are in impressive agreement with the expectations of the QCD improved Drell-Yan mechanism.

10197 (KEK—85-5, pp 178-188) **Muonic decay of the Z^0.** Leuchs, R. (Kiel Univ., Germany, F.R.). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

In an integrated luminosity of $\int L.dt = 378\ nb^{-1}$ we observe 9 events of the type $Z^0 \rightarrow \mu^+\mu^-$ at the p anti p-collider with the UA1-detector. From these events we calculate the Z^0-mass to be 88.8 (+5.5, -4.6) GeV/c^2.

10198 (KEK—85-5, pp 189-193) **Observation of tau decay from W → tauνsub(tau) in a UA1 experiment.** Mendiburu, J.-P. Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Since the discovery of the W by the UA1 Collaboration in 1983, we have published the measurements of its decay in leptonic and muonic modes. We report here the first observation of the decay W → tauνsub(tau), in 1983 data.

10199 (KEK—85-5, pp 194-222) **Study of W^{+-} and Z^0 in UA2.** Borer, K. (Bern Univ., Switzerland). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

A preliminary analysis of high p sub(T) electrons detected in the UA2 experiment at the CERN anti p p Collider ($\sqrt{s} = 546$ and 630 GeV) has been done. Results on W^{+-} and Z^0 production and properties are presented and compared to the expectations from the Standard Electroweak Model. We find good agreement between the UA2 experimental results and theoretical predictions.

10200 (KEK—85-5, pp 409-430) **Associated production of lepton and jets.** Minard, M.N. Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

A clean signal has been observed for the production of an isolated large-transverse-momentum lepton in association with two jets. The rate and feature of these events are not consistent with expectation from known quark decays (charm, bottom). These are consistent as being the manifestation of t-quark decay, t being the sixth quark from Cabibbo current, through 2 processes $W \rightarrow t$ anti b or p anti $p \rightarrow t$ anti t, followed by semi-leptonic decay of the t-quark. That interpretation bounds the mass of the top quark in the range $30 <$ msub(t) < 50 GeV/c^2.

10201 (KEK—85-5, pp 46-65) **Large-t elastic scattering and diffraction dissocation.** Timmermans, J. (NIKHEF-H, Amsterdam, Netherlands). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Recent results, both from the ISR and the S anti p pS Collider, on proton-antiproton elastic scattering at large values of the four-momentum transfer squared, are presented. The results are compared with predictions of several theoretical models of high-energy collisions. Single diffraction dissociation at the Collider is also discussed.

10202 (KEK—85-5, pp 81-96) **New results on jet fragmentation at the CERN SPS collider.** Ghez, P. (Annecy, LAPP, France). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

New results are described of jet fragmentation into charged tracks in the UA1 experiment. A new estimate of the fragmentation function shows strong differences between our data and those of PETRA. A preliminary analysis suggests a different quark and gluon fragmentation which is well reproduced by a recent model. The observed scaling violations of the fragmentation function and of the internal p sub(T) are consistent with QCD expectations.

10203 (KEK—85-5, pp 97-122) **Latest results on high-P sub(T) jets in UA2.** Froidevaux, D. (LAL, Orsay, France). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Results on high p sub(T) jets from the UA2 experiment at the CERN anti p p Collider are presented. The inclusive jet cross sections are found to be in good agreement with QCD predictions, which places limits on the compositeness scale of quarks. The ratio of three jet to two jet events is shown to be a sensitive test of QCD. A status report on the search for exotic events with large missing transverse energy is presented. There was no evidence for any significant signal above background for either monojets or multi-jets with large missing transverse momentum. The data sample corresponds to the 1984 anti p p Collider run ($\sqrt{s} = 630$ GeV, $\int L\,dt = 310\ nb^{-1}$) and all the results presented here are preliminary.

10204 (KEK—85-5, pp 390-408) **Intermediate mass dimuon events.** Moser, H.-G. (RWTH Aachen, Germany, F.R.). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

We report the observation of 67 dimuon events at the CERN p anti p collider with the UA1 detector. The events will be interpreted in terms of the Drell-Yan mechanism, J/PSI and UPSILON decays and heavy flavour production.

10205 (KEK—85-5, pp 431-454) **Associated production of W's and Z's with jets in UA2.** Clark, A.G. (CERN, Switzerland). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

In the 1983 CERN anti p p collider run, at $\sqrt{s} = 546$ GeV and with an integrated luminosity of 126 nb^{-1}, the UA2 collaboration observed 3 events containing a well identified electron produced in association with a large missing tranverse momentum and a hard jet or jets. These events were found difficult to be interpreted in terms of QCD W production. The absence of similar new events in the 1984 data sample, despite the increased energy ($\sqrt{s} = 630$ GeV) and the larger integrated luminosity ($L = 310\ nb^{-1}$), makes the interpretation of the 1983 data in terms of standard QCD W + jet(s) production much more likely. In the total data sample, 128 events interpreted as $W \rightarrow e\nu$ decays with missing transverse momentum exceeding 25 GeV/c are observed in low background conditions. Of those, 31 events are associated with a jet of transverse energy exceeding 5 GeV. Including these events with hard jets, an average psub(perpendicular) sup(W) of 8.5 +- 0.8 GeV/c is measured.

10206 (KEK—85-5, pp 8-27) **Forward elastic scattering and total cross-section at very high energies.** Castaldi, R. (Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The successful cooling technique of antiproton beams at CERN has recently allowed the acceleration of proton and antiproton bunches simultaneously circulating in opposite directions in the SPS. Hadron-hadron collisions could so be produced at a centre-of-mass energy one order of magnitude higher than previously available, thus opening a new wide range of energies to experimentation. This technique also made it possible to replace one of the two proton beams in the ISR by a beam of antiprotons, allowing a direct precise comparison, by the same detectors, of pp and anti pp processes at the same energies. The recent results are summarized of the forward elastic scattering and total cross-section in this new energy domain.

10207 (KEK—85-5, pp 68-80) **Jet production and QCD in the UA1 experiment.** Scott, W. Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Comparison was made between three-jet and two jet cross-sections in p anti p collisions measured in the UAI apparatus at the CERN Super Proton Synchrotron (SPS) p anti p Collidor. The motivation for this study stems from the need for a better understanding of general multijet production (three or more jets) in high-energy p anti p collisions. In quantum chromodynamics (QCD), multijet events can occur as a result of strong radiative corrections to elastic parton-parton scattering processes. At sufficiently high process c.m.s. energies, single QCD bremsstrahlung should become the dominant mechanism for the production of three-jet events. In this paper the bremsstrahlung hypothesis is tested by comparing the measured three-jet differential cross-section, at the highest available energies, with the predictions of the single bremsstrahlung formulae. The observed relative rate of three-jet and two-jet events is used to obtain information on the value of the strong interaction coupling constant αsub(s). Observations carried out include the two-jet and three jet angular distributions, Dalitz plot for a three-jet sample, and the three-jet/two-jet ratio, and dicussions are made based on results obtained.

10208 (KEK—85-5, pp 138-157) **Heavy quark and s particle phenomenology.** Barger, V. (Wisconsin Univ., Madison, USA. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Data from the CERN p anti p collider provide a new avenue for the study of heavy-quark production and possibly also provide the first indication for the s particles of supersymmetry. This discussion of the associated phenomenology begins with charm and bottom quarks, proceeds to the strategies that lead to top quark identification, and concludes with possible supersymmetry scenarios to explain the events observed by the UA1 collaboration with large missing transverse momentum. The fusion predictions of single muon and dimuon rates are in the ballpark of UA1 observations. The discovery of isolated like-sign dimuons is at present an anomaly. The p anti p collider is a good place to do B physics, and answer the question of whether B^0 - anti B^0 mixing occurs. Also, it should soon be possible to identify a few dimuon events of W → t anti b and t anti t origins. Finally, enhanced charm in jets, if established, would have to be ascribed to non-perturbative QCD effects. In conclusion, if the UA1 monojets are of supersymmetry origin, then s quark and gluino masses are already tightly constrained and dijet events with large missing transverse momentum should help distinguish between the two most promising scenarios. The top signal is not being faked by s particles.

10209 (KEK—85-5, pp 499-518) **Supercollider physics.** Quigg, C. (Fermi National Accelerator Lab., Batavia, IL, USA). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

An attempt is made to clarify the current knowledge and future possibilities in the field of supercollider physics, mainly by citing a previous article by the author and coworkers and the many workshops on supercollider physics held during the past year. Considerations are made over parton distributions, QCD jets, electroweak physics and heavy Higgs bosons, on the basis of various culculated results. Parton distribution is discussed in terms of uncertainties concerning the input, the treatment of heavy flavors, and QCD perturbation theory. QCD jets are discussed based on the calculated inclusive cross section for jet production in anti pp collisions, invariant mass distribution of two jets, and transverse energy. For electroweak physics, some results including the integrated cross sections for W^+ and W^- production, rapidity distribution for W^+ production and Feynman diagrams are shown and discussed. Concerning heavy Higgs bosons, comparisons of expected signal and background are carried out. On the basis of these considerations, the author reaches the conviction that a high-luminosity multi-TeV hadron collider will meet the objective of exploring the TeV energy scale and illustrating the nature of electroweak symmetry breaking. Some areas in which further work is required are also described.

10210 (KEK—85-5, pp 520-565) **Anti p p collider physics: summary talk.** Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL, USA). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

This report summarizes the International Symposium on Physics of Proton-Antiproton Collision, Tsukuba, Japan (March 1985). In the first section, quantum chromodynamics are outlined in terms of Drell-Yan production of W and Z, inclusive spectra of jets, angular distribution of two jet final states, Dalitz plot analysis of three jet final states, interior structure of jets, and minijets. Subsequent sections are devoted to soft physics, W, Z and electroweak theory, heavy quark physics, extinct exotica, and extant exotica. In the section for soft physics, some issues and relevant data are described and structure of the pomeron is discussed, while the section for extant exotica consists of three subsections dealing with monojets, top quark, and possibly anomalous same sign isolated dimuons. Finally, future directions are shown concerning Sp anti pS and Tevatron I and in the field of instrumentation and detectors, and in addition, a commentary on the status and future of the SSC is given. Various measured results, for the most part obtained by UA1 and UA2, are also presented.

10211 (KEK—85-5, pp 349-370) **Physics with CDF.** Miyashita, S. (Tsukuba Univ., Sakura, Ibaraki, Japan). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

The success of S anti ppS detectors in isolating interesting parton-parton collisions clearly from the less interesting beam-beam background has made the prospect of TeV-I physics even more exciting because of the higher energy and higher luminosity that TeV-I is designed to deliver. In this report, discussion are focussed on important physics with CDF which are possible only at the higher energy and higher luminosity. Among those are testing the gauge structure of the electro-weak interaction, probing the compositeness scale of quarks, and studying W-decay channels with increased statistics. Investigations made include transverse momentum distribution, invariant mass distribution, energy flow distribution, rapidity distribution, and Drell-Yan cross sections. Results are described and discussed. The standard model has been established to a surprising degree by S anti p pS. That the observed masses of W and Z come within less than 10 % of the prediction has created more misteries on symmetry breaking mechanism. It is absolutely the must of TeV-I to go beyond the standard model. Since the Higgs discovery seems almost hopeless at CDF, alternates must be looked for somewhere else, namely the gauge coupling structure, compositeness, and SUSY.

10212 (KEK—85-6, pp 307-364) **Underground experiment at Kamioka.** Totsuka, Y. (Tokyo Univ., Japan. Faculty of Science). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

The underground facility at Kamioka can be extended to be one of the active centers for the future high energy physics in Japan. It will focus on the ultra-high energy physics through searches for rare phenomena.

10213 (KEK—85-6, pp 141-167) **Searching for Higgs.** Iwasaki, H. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

The possibility is estimated to find the heavy Higgs boson with multi-tens-TeV hadron colliders. Production cross section of the heavy Higgs is quite large. The dominant process is the intermediate vector boson (IVB) fusion. The heavy Higgs boson decays predominantly into a WW or ZZ pair with the branching ratio of - 2/3 for WW and - 1/3 for ZZ. Helicity states of these vector bosons are dominated by longitudinal polarization. These W or Z further decay into a jet pair or a lepton pair. We concentrate on the cases where one of the vector bosons decays into a jet pair and the other into a lepton pair. In order to get a general view, we study the decay modes with a simple Monte Carlo simulation. We estimate event rates for the signals and backgrounds and investigate the possibility to find the heavy Higgs.

10214 (KEK—85-6, pp 219-235) **Is it possible to detect W boson by hadron calorimeter.** . Kato, Kiyoshi. (Kogakuin Univ., Tokyo, Japan). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

Monte Carlo code ISAJET developed by Paige was used to generate the W^+W^- pair and QCD jets and to see whether the hadronic decay of W boson is distinguished from QCD jet or not. The conclusion is that a considerable number of QCD jets have the structure in the energy flow similar to that of W boson. So it will be very hard to discriminate between the hadronic decay of a weak boson and a QCD jet only by a hadron calorimeter.

10215 (KEK—85-6, pp 118-140) **Identification of W jets and heavy quarks at the SSC.** Kim, S.; Takikawa, K. (Tsukuba Univ., Sakura, Ibaraki, Japan. Inst. of Physics). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

A variety of physics topics to test and to go beyond the standard model can be studied with the superconducting super collider (SSC) or with the large hadron collider (LHC). We focus on specific subjects at high energy hadron colliders and report on a simulation study of the feasibilities of detecting the W jets and the heavy quarks of the 4th generation. The second subject of our simulation study is identification of heavy quarks of the 4 th generation. The question of how many quark/lepton generations are is one of the outstanding puzzles in the understanding of particle physics. The SSC or LHC with its huge CMS energies available provides a good place to search for new heavy particles.

10216 **(KEK—85-6, pp 210-218) Data processing and related topics.** Hayano, R.S. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

Discussions were carried out on computing requirements for future hadron collider experiments. These requirements contains not only data aquisition and online monitoring but following items such as detector design and software development, higher level trigger processing, raw data processing, physics analysis, Monte Carlo Simulations, and networking. This report deals with brief considerations on the abovementioned items and possible solutions for these problems in respect to computing requirements corresponding to the capability of M200H equivalents, vector and/or parallel data processing, optical disk recording, reduction technology of 100 MH$_2$ triggers to 1 H sub(z), networking of very high band width. It was concluded that large amount data processing from a future hadron collider detectors was very interesting in the technological basis. If computing cost reduction could be achieved, it was concluded that total computing power necessary for the development of 100 - 200 M200 equivalents might become available. Technological developments such as optical recording shall accompany the above-mentioned computer upgrading. Development of multi-micro-processor farms is also required especially for the on-line high-level filtering and increasing off-line computing power. The requirements of reduction of 100 MH sub(z) triggers to 1 MH$_2$ looked very difficult to solve in the present technical basis but they should be solved by continuing studies and continuous information exchanges on this subject.

10217 **(KFK—4110) Recent results on new particle searches at PETRA.** Kuester, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Jul 1986. 27p. (CONF-8603118—7). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750317.

From 21. Recontre de Moriond: perspectives in electroweak interactions and unified theories; Les Arcs, France (9 Mar 1986).

Recent searches for new particles at PETRA are reviewed. Results on heavy lepton searches (charged and neutral), supersymmetry searches (SUSY partners of the electron, the photon, the W and Z gauge bosons, and the Higgs), and on searches for compositeness (excited leptons and leptoquarks) are presented.

10218 **(LA-UR—86-3398) Measurement of the gravitational acceleration of the antiproton: an experimental overview.** Jarmie, N. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 12p. (CONF-861114—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001955.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

An ambitious experiment is being developed to measure the force on the antiproton due to the gravitational field of the earth. The technique consists in obtaining antiprotons of the lowest energy possible from the LEAR facility at CERN, decelerating them further in an external beam line, trapping and cooling them to ultralow energy, and measuring their gravitational acceleration by time-of-flight methods. The experiment has been granted CERN approval (PS-200). Present plans and initial development efforts are described.

10219 **(LA-UR—86-3749) Measurement of spin observables in pion-nucleon scattering at LAMPF.** Sadler, M.E.; Engelage, J.; Kim, G.K.; Nefkens, B.M.K.; Wightman, J.A.; Ziock, H.J.; Briscoe, W.J.; Mokhtari, A.M.; Seftor, C.J.; Fitzgerald, D.H. (Los Alamos National Lab., NM (USA); Abilene Christian Univ., TX (USA); California Univ., Los Angeles (USA); George Washington Univ., Washington, DC (USA)). 1986. Contract W-7405-ENG-36. 3p. (CONF-8609151—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002926.

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

10220 **(SLAC-PUB—4055) New results on charmed D, F^{+-} and F^* production and decay from the Mark III.** Schindler, R.H. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1986. Contract AC03-76SF00515. 8p. (CONF-860701—63). NTIS, PC A02. File Number DE87003273.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

Results on charmed meson production and decay are presented from the Mark III at SPEAR. F anti F^* associated production is observed allowing a direct measurement of the F^* mass. A search for the decay $D^+ \rightarrow \mu^+$ nu/sub μ/ in the recoil of hadronically tagged D^{+-} decays provides a stringent limit on the pseudoscalar decay constant f/sub D/. New results on D^0 anti D^0 mixing from semileptonic D^0 decays and evidence for a nonresonant component in D/sub e4/ decays are also presented.

10221 **(SLAC-PUB—4102) New PEP tau and B-lifetime results.** Ritson, D.M. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1986. Contract AC03-76SF00515. 4p. (CONF-860701—61). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003278.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

New results on tau and B-lifetimes obtained at the PEP colliding beam ring are presented, including results from MAC and DELCO detectors.

10222 **(SLAC-PUB—4143) Perspectives in e^+e^- physics.** Feldman, G.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1986. Contract AC03-76SF00515. 9p. (CONF-860943—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003264.

From 6. physics in collision; Chicago, IL, USA (3 Sep 1986).

After a brief enumeration of the advantages of electron-positron collisions to study elementary particle physics, the present and future of electron-positron facilities are briefly reviewed, and the perspectives for future physics with electron-positron collisions are discussed. 20 refs., 10 figs. (LEW)

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 9719, 10265, 10275, 10463

10223 **(BONN-HE—86-12) On the order of the finite temperature chiral phase transition in QCD.** Margaritis, A.; Patkos, A. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jun 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750308.

A differential renormalisation group equation is derived for the effective potential of the chiral order parameter of a theory with Nsub(f) light flavors. Its solution for Nsub(f)=3 provides further support to the first order nature of the finite temperature restoration of chiral symmetry in QCD.

10224 **(BONN-HE—86-21) Mass-shell properties of the dynamical quark mass.** Reinders, L.J.; Stam, K. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jul 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750307.

We discuss the running dynamical quark mass in the framework of the operator product expansion. It is shown that for vertical strokep^{2}vertical stroke$>m^2$ the quark-condensate part of the quark self energy has no contributions of order m^2 or higher, and is frozen to its mass-shell value for smaller vertical strokep^{2}vertical stroke.

10225 **(CONF-8609163—4) On the possibility of QED (e^+e^-) resonances at 1.6 to 1.8 MeV.** Wong, Cheuk-Yin. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 9p. NTIS, PC A02. File Number DE87002418.

From International conference and symposia on unified concepts of many-body problems; Stony Brook, NY, USA (4 Sep 1986).

QED (e^+e^-) resonances are explored as possible sources of the anomalous positron peak(s) in heavy-ion collisions. For the $^3P_0$(j/sup PC/ = 0^{++}) state, a model magnetic interaction gives a resonance at 1.579 MeV and a two-body decay mean life of 4.2 x 10^{-19} sec, while the constraint relativistic dynamics of Crater and van Alstine give a singular super-critical attractive potential at the origin. More experimental and theoretical investigations are needed. 29 refs., 2 figs.

10226 **(DESY-T—85-01) Two jet cross section in order αsub(s)^2.** Lampe, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Fachbereich Physik). Feb 1985. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750320.

The two jet cross section is calculated in the two loop approximation. One receives a generalisation of the so called Sterman-Weinberg formula. In the course of the work poles of fourth order in the dimensional parameter appeared. We developed methods to handle them.

10227 **(DOE/ER/10336—8) Investigations in particle and field theory: Progress report for period December 1, 1985-November 30, 1986.** Haller, K.; Islam, M.M.; Mannheim, P.D.; Caldi, D.G. (Connecticut Univ., Storrs (USA)). Nov 1986. Contract AC02-79ER10336. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002952.

Work is reported on temporal gauge formulations of gauge theories, first quantization of relativistic point classical systems and in the early universe, string theory, lattice gauge theory, and the origin of a significant C-odd amplitude in high energy elastic scattering. (LEW)

10228 **(DOE/ER/40211—2) Research in theoretical physics: Annual progress report for period April 1, 1986-March 31, 1987.** Domokos, G.; Kovesi-Domokos, S. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy). Nov 1986. Contract FG02-85ER40211. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002944.

Progress is reported in the composite models of quarks and leptons and gravitational theories in higher dimensions, as well as the study of the problem of anomalously large number of muons in interactions with CMS energy on the order to 10 TeV. 20 refs. (LEW)

10229 **(EFI—802(29)-85) Production and decays involving pseudoscalar glueballs.** Eremyan, Sh.S.; Nazaryan, A.Eh. (Erevanskij Fizicheskij Inst. (USSR)). 1985. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700199.

The production and decay reactions containing eta, eta' and i(1440) mesons are considered to clarify the quark composition of those mesons, as well as to obtain information on quark - gluon mixing in them. We have given the predictions for a large number of the two-body decays with the eta, eta' and i(1440) pseudoscalr glueballs, and also the ones for the differential cross sections of production of those glueballs in the hypercharge exchange reactions. 13 refs.; 7 figs.

10230 **(EFI—807(34)-85) Quark-gluon mechanism of Hsup(0)-boson associated production in p anti p (pp) collisions.** Alanakyan, R.A.; Grigoryan, S.G.; Dul'yan, L.S.; Matinyan, S.G. (Erevanskij Fizicheskij Inst. (USSR)). 1985. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700200.

A mechanism of standard H^0-boson production in the reaction p anti p (pp) → H^0FFX, where F, anti F are hadrons containing heavy quarks, is studied. A behaviour of the total cross section of this reaction with the initial energy of colliding beams $\sqrt{S_0}$, the heavy quark mass M and the Higgs particle mass Msub(H), is studied within the QCD parton model. Thus, at $\sqrt{S_0} = 540$ GeV. Msub(H) = 10 GeV and M = 4.5 GeV the total cross section is 20 pb, while at $\sqrt{S_0} = 2$ TeV for the same masses it is 300 pb. 19 refs.; 9 figs.

10231 **(IN2P3—84-01, pp 107-133) Mesic liberty degrees and baryonic excitations (Theoretical approach).** Desplanques, B. (Paris-11 Univ., 91 - Orsay, France. Inst. de Physique Nucleaire). 1986. (In French). Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris, France. (CONF-8409254—).

From 3. Joliot-Curie School on nuclear physics: mesons, baryons, quarks; Bombannes, France (16 Sep 1984).

The aim of this course is to review a few contributions which characterize degrees of freedom which are often neglected in the nucleus description such as mesons, antinucleons or baryonic resonances. The first part is devoted to the general description of these degrees of freedom and to the way they are accounted for in the nucleon-nucleon interaction. The emphasis is put on a few points which will become important in the next part. The second part considers the contributions of these degrees of freedom to electromagnetic processes, in particular to magnetic transitions M1 in light nuclei, where they have the most striking effect. Similarities and differences with those in heavier systems are briefly discussed.

10232 **(IN2P3—84-01) 1984 Joliot-Curie School of Physics: Mesons, baryons, quarks and nuclear physics.** (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)). 1986. vp. (In French). (CONF-8409254—). Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris, France.

From 3. Joliot-Curie School on nuclear physics: mesons, baryons, quarks; Bombannes, France (16 Sep 1984).

Individual papers for these proceedings have been abstracted separately. (DWL)

10233 **(INIS-mf—10512, pp 25) Standard model - the ultimate description of matter.** Rubbia, C. (European Organization for Nuclear Research, Geneva, Switzerland). 1986. NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10234 **(INIS-mf—10512, pp 30) Charge symmetry breaking in the n-p scattering.** Thaler, J.; Iqbal, J.; Woloshyn, R. (TRIUMF, Vancouver, British Columbia, Canada). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10235 **(INIS-mf—10512, pp 80) On the ratio GAMMA (B → Dsup(*)) / (GAMMA (B → D) + GAMMA (B → Dsup(*))).** Schoeberl, F.; Pietschmann, H. (Vienna Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10236 **(INIS-mf—10512, pp 82) QCD-motivated short range complement to the meson exchange potential in the nucleon-nucleon interaction.** Leeb, H.; Meczes, A.; Fiedeldey, H.; Sofianos, S.A. (Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik; South Africa Univ., Pretoria. Dept. of Physics). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10237 (INIS-SU—353, pp 42-45) **Radiation of decaying particles.** Dremin, I.M.; Nazirov, M.T.; Saakyan, V.A. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780034.

Kratkie Soobshcheniya po Fizike.; (No. 6).

In Experimental and theoretical physics. Collection.

Radiation of decaying charged particles is directed at larger angles than conventional bremsstrahlung due to the resticted particle path length. This fact may be used to measure lifetimes of very short-living particles. To assess the value and character of the effect the reaction of heavy lepton production by a neutron beam is considered. Heavy lepton (muon, tau) may emit photon before decaying. Lepton lifetime determines photon angular distribution. 4 refs.

10238 (INIS-SU—361, pp 42-44) **Neutral scalar meson production in the QCD jets.** Andreev, I.V. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780036.

Kratkie Soobshcheniya po Fizike.; (No. 8).

In Experimental and theoretical physics. Collection.

Using effective Lagrangian of the chromodynamics estimation of probability of neutral scalar meson production representing gluon and quark condensate excitations is given.

10239 (IPNO-TH—85-38) **Baryon masses in relativistic potential models.** Basdevant, J.L.; Boukraa, S. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jul 1985. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750782.

We study the spectrum of a semi relativistic three-body Hamiltonian. The hyperspherical method proves to be very efficient. We show that the ground-states of baryons can be calculated with good accuracy. However, when using the meson potential, together with the colour assumption Vqq = 1/2 Vqanti-q, baryon Regge slopes come out noticeably too small. We analyze this problem and show that a quark-diquark structure for baryons cures this defect. Altogether the construction of a global unified potential model for mesons and baryons seems quite hopeful.

10240 (IPNO-TH—85-46) **Chou-Yang model: What have we learned.** Lombard, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 8p. (CONF-8506197—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750777.

From Workshop on elastic and diffractive scattering at the collider; Chateau de Blois, France (3 Jun 1985).

We discuss the domain of validity of the Chou-Yang conjecture, which relates elastic scattering of hadrons at high energies to their electromagnetic form factors. It is found to be verified within a few percents in the forward diffraction peak. Within this range, the model is shown to yield valuable information on the electromagnetic form factor of unstable particles. It also provides a way of calculating the polarization of proton-proton elastic scattering in the framework of a strong absorption model.

10241 (IPNO-TH—85-60) **Baryon spectroscopy and multiquark systems.** Zouzou, S.R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-6 Univ., 75 (France)). 1985. 100p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750784.

The main aim of this thesis is to study the existence of multiquark states in the framework of non-relativistic potential models. First, after an introduction, we present the model. Then, we examine the case of mesons, only for the purpose of illustration, and more deeply the case of baryons. We then come to the study of the existence of multiquark states made of two quarks and two antiquarks. The conclusion is that it's difficult to obtain stable four quark states.

10242 (ITEF—69(1984)) **Role of π-mesonic sea of a nucleon in production of mesons with hidden flavor (phi, I/PSI, UPSILON).** Arakelyan, G.G.; Boreskov, K.G.; Turbiner, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki; Erevanskij Fizicheskij Inst. (USSR)). 1984. 34p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700201.

Contribution of π-meson exchange mechanism to processes of meson hadroproduction with hidded flavor (phi, J/psi, psi') is discussed. Parametrization of differential cross sections of these meson production in πN collisions has been performed. Parton interpretation of the model and, in particlar, parton compostion of pion cloud of nucleon is discussed Problem of hidden flavor meson production associatively with open flavor particules and related problem of overlapping of π-meson exchange diagrams have been considered. Results of calculations of psi, J/psi, phi' and UPSILON meson production cross sections in nucleon-nucleon collisions are given. A method for separation of contributions of quark-antiquark annihilation mechanisms and gluon-gluon coalescence to these processes has been suggested. 26 refs.

10243 (ITP—85-33-E) **Dynamical mass function of quark and effective potential in QCD.** Gusynin, V.P.; Sitenko, Yu.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700202.

Direct variational method is applied to the problem of the dynamical breaking of chiral symmetry in QCD. The minimum of the effective potential corresponding to the phase with spontaneous chiral symmetry breaking is found. 20 refs.; 2 figs.

10244 (JINR—E-2-85-260) **Scalar gluonium and pseudoscalar goldstone mesons.** Lanik, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700203.

Recently suggested effective Lagrangian models for couplings between the low-lying scalar gluonium and pseudoscalar Goldstone mesons, based on the nonlinear realization of chiral symmetry, are reviewed. These phenomenological Lagrangians satisfy low-energy theorems of broken chiral symmetry and scale invariance, and in such a way, they automatically lead to the non-zero anomalous trace of the energy-momentum tensor. Demanding consistency of this phenomenological trace anomaly with the anomalous trace of the energy-momentum tensor of QCD, and furthermore, assuming that the anomaly is dominated by a single low-lying scalar gluonium, it is concluded that such a glueball is probably too broad to be recognized as a well-defined resonance. Thus, this can be the source of troubles in the search for the low-lying scalar glueball. 19 refs.

10245 (KEK—84-20, pp 3-27) **Frontier of physics with strange particles.** Yamazaki, T. (Tokyo Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

I deliver my own perspectives on possible domains of physics underlying between particle physics and nuclear physics, which can be studied by using strange particles produced abundantly by the KEK 12 GeV proton synchrotron. My guiding principle on the scientific program at KEK (National Laboratory for High Energy Physics) is to promote experiments of brand new types and thus to create something new. Unfortunately, particle physics and nuclear physics seem to have been separated too much, but in such a playground as the KEK PS, these two aspects of physics can well be coupled to each other. Namely, particle physics provides new types of probes to nuclear physics, while nuclei provide abnormal external conditions to particles. Contents are the following: search for exotic particles in K^+ decay, right-handed sector, new aspects in nuclear physics, new type of hypernuclear spectroscopy, promising future at KEK.

10246 (KEK—84-20, pp 231-244) **Baryonic excitations in high-energy proton-nucleus collisions.** Chiba, Junsei. (Tokyo Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Using a large acceptance spectrometer, we have measured multi-particle productions from collsions of 4 GeV/c protons on target nuclei. Baryonic resonances have been studied through analyses of invariant mass distributions. A narrow peak (GAMMA – 30 MeV) at a mass around 1200 MeV was observed in $p\pi^-$ invariant mass spectra for events with a leading particle in the reaction of 4 GeV/c p + Al. Some possible explanations related to this observation are discussed.

10247 (KEK—85-4, pp 68-82) **Unstable neutrinos and galaxy formation.** Fukugita, M. (Kyoto Univ., Japan. Research Inst. for Fundamental Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

We discuss the possibility that neutrions other than the electron neutrino have masses larger than the conventional cosmological limit. Galaxy formation triggered by such heavy neutrinos is also discussed.

10248 (KEK—85-4, pp 173-182) **Composite gauge bosons of hidden local symmetries.** Kugo, T. (Kyoto Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

For any nonlinear sigma models there exist hidden local symmetries intrinsic to them. We suggest that it may be a rather popular phenomenon that the composite guage fields corresponding to such hidden local symmetries acquire their kinetic terms. As an example, the rho meson is identified with the composite gauge bosons of the hidden SU(2) sub(V) local symmetry of nonlinear chiral SU(2) sub(L) x SU(2) sub(R) Lagrangian. The totality of rho meson phenomenology seems to support our ideas of this identification.

10249 (KEK—85-5, pp 223-251) **Clean test of the electroweak theory by measuring weak boson masses.** Hioki, Zenro. (Tokushima Univ., Japan). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Role of the weak boson masses in the studies of electroweak higher order effects is surveyed. It is shown that precise measurements of these masses give us quite useful information for performing a clean test of the electroweak theory, and for a heavy fermion search. Effects of supersymmetric particles in these studies are also discussed.

10250 (KEK—85-5, pp 28-45) **Jets in minimum bias physics.** Pancheri, G.; Srivastava, Y. (Harvard Univ., Cambridge, MA, USA. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Discussion was made on a phenomenological evidence to support the hypothesis that several new phenomena observed in low psub(t) physics are due to the presence of low-x QCD jets in minimum bias physics. The phenomena we examine are KNO scaling violations, growth of <psub(t)> with multiplicity and rise of the non-single diffractive part of the total cross-section. We have discussed the importance of low-x hard parton scattering in minimum bias events and pointed out its connection to both KNO scaling violations as well as to the observed growth of <psub(t)> with multiplicity in inclusive pion distributions. The contribution of these mini-jets to the total cross-section has been calculated and a model for the transverse energy distribution characterizing any event accompanied by jets has been presented.

10251 (KEK—85-5, pp 123-137) **QCD hard processes in anti p p collision.** Kodaira, Jiro. (Hiroshima Univ., Japan. Dept. of Physics). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Some aspects of quantum chromodynamics (QCD) at short distance are reviewed. The vector boson productions in anti p p collision are discussed with special emphasis on the soft gluon effects. The jets at large p sub(T) and the jet activities associated with vector bosons are also briefly mentioned.

10252 (KEK—85-5, pp 456-487) **Heavy flavour production and weak mixings.** Ali, A. (CERN, Geneva, Switzerland. Theory Division). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

Heavy flavour production at the CERN anti p p Collider and in e^+e^- annihilation are reviewed in the context of perturbative QCD. We emphasize in particular the dilepton states p anti p → $l^{+-}l^{+-}x$, l^+l^-x and $e^+e^- \rightarrow l^{+-}l^{+-}x$, l^+l^-x in view of the theoretical predictions of large weak mixings in the Bsub(s)^0 - anti Bsub(s)^0 mesons. It is argued that the large dimuon ratio $(\mu^+\mu^- + \mu^-\mu^-)/\mu^+\mu^-$ measured at the CERN Collider is very likely due to such a mixing. Some consequences of B - anti B mixings for the ongoing e^+e^- and planned LEP experiments are also presented.

10253 (KEK—85-5, pp 488-497) **Supersymmetry and compositeness; dynamical weak gauge bosons.** Yanagida, T. (Tohoku Univ., Sendai, Japan. Coll. of General Education). Aug 1985. NTIS (US Sales Only), PC A25/MF A01. File Number DE87780046. (CONF-8503151—).

From International symposium on physics of proton-antiproton collision; Tsukuba, Japan (13 Mar 1985).

We show at the leading order of 1/N expansion that composite gauge fields in a supersymmetric U(4n + 2)/U(4n) x SU(2) non-linear sigma model become dynamical in some range of parameters. Since the hidden local symmetry in this sigma model is identifiable with a weak SU(2) of the standard electroweak model, we suggest that the observed weak bosons W^{+-} and Z^0 are indeed the dynamical gauge fields in the non-linear sigma model. Some phenomenological difficulies in identifing such composite fields with W^{+-} and Z^0 are discussed. We also give a brief review on a supersymmetric preon model which generates our non-linear sigma model as a low-energy effective theory. I. Introduction. In spite of the excellent success of the standard electroweak gauge theory [1], it is still unclear to us what the origin of the spontaneous breakdown of the SU(2) x U(1) symmetry is. In the standard scheme, an elementary Higgs scalar phi is assumed to have a vacuum-expectation value <phi> not equal 0 which induces the breaking of the electroweak symmetry. The Fermi scale G sub(F)sup(-1/2) is thus related basically to the undetermined, free parameter, <phi>.

10254 (KEK—85-6, pp 236-247) **E^+e^- reaction at very high energy.** Munehisa, Tomo. (Yamanashi Univ., Kofu, Japan. Faculty of Engineering). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

We show cross sections of various processes and introduce the cluster analyses suitable to multi-jets events.

10255 (KEK—85-6, pp 248-259) **B physics in the standard model.** Takasugi, Eiichi. (Osaka Univ., Toyonaka, Japan. Coll. of General Education). Aug 1985. NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

Before discussing the beauty physics, the present status of the quark mixing is reviewed. Then the CP violation in the K meson physics is discussed. As for the quark mixing, it is concluded that the theroretical analysis of CP violation involves various uncertainties and it seems difficult to obtain the definite information of the quark mixing. As for the B physics, B^0 - anti B^0 mixing and some hopeful methods to detect the CP violation in the B system are discussed along with the two typical ways to measure it. In summary, it is concluded that the B^0 - anti B^0 mixing should be observed, but some luck is needed to observe the CP violation in the B physics.

10256 (LA-UR—86-3533) **Proton decay in the superworld.** Raby, S. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 24p. (CONF-8608138—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001952.

From 24. course of the international school of subnuclear physics on the super world; Erice, Italy (7 Aug 1986).

Predictions are elaborated for nucleon decay in supersymmetric grand unified theories (SUSY GUT's). A minimal SU_5 SUSY GUT is described, as well as SU_5 breaking. The low energy theory and breaking of supersymmetry are discussed. It is concluded that nucleon decay in SUSY GUT's would be dominated by p → K^+anti nu/sub μ/ and n → K^0anti nu/sub μ/. There are ranges in parameter space for which other decay modes may be significant or may even dominate, it is found. It is noted that minimal SUSY GUT's typically predict a value of $\sin^2\theta$/sub w/ of order .233. 20 refs., 7 figs. (LEW)

10257 (LYCEN—8546) **Constraints and excited states of the bag.** Guichon, P.A.M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Jun 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750781.

The implications of the constraints which affect the static bag solutions are investigated in the case of radial excitations. It is found that the Roper resonances cannot be static excited states of the bag.

10258 (RRK—85-23) **Quasi two-body decays of D^0 meson.** Terasaki, K.; Oneda, S. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Aug 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700248.

Quasi two-body decays of D^0-meson are studied from an algebraic approach, using a hard meson extrapolation. In this innovation of old current algebra with new perspective, a reasonable unified description of K sub(S) → 2π and D^0 → K-barπ decays has been obtained previously, keeping only the contribution of ground state mesons to the now surviving surface term. In this paper, it is shown that quasi two-body decays can also be accomodated reasonably well in the same scheme. A distinctive feature of our result is that GAMMA(D^0 → phi K-bar^0) is sizable, while D^0 → rho^{0}K-bar^0 is relatively suppressed.

10259 (RRK—85-26) **Primary fields in a unitary representation of Virasoro algebras.** Sasaki, R.; Yamanaka, I. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Aug 1985. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700249.

A unitary representation of Virasoro algebras with the central charge $c = 1 - 6/(N + 1)(N + 2)$ is constructed explicitly in terms of a colored (two color) coset space (the complex projective space CP sup(N-1)) quark model. By utilizing the explicit forms of the Virasoro generators Lsub(m), we derive a general method of constructing the primary fields (fields with well-defined conformal transformation properties) of the above Virasoro algebras.

10260 (SLAC-PUB—4018) **Heavy quark production in quantum chromodynamics.** Brodsky, S.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1986. Contract AC03-76SF00515. 9p. (CONF-860701—60). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003270.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

For very heavy quark masses, the inclusive hadronic production of hadron pairs containing heavy quarks is predicted to be governed by QCD fusion subprocesses. For intermediate mass scales other QCD mechanisms can be important including higher-twist intrinsic contributions and low relative velocity enchancements, possibly accounting for the anomalies observed in charm hadroproduction, such as the nuclear number dependence, the longitudinal momentum distributions, and beam flavor dependence. We also discuss scaling laws for exclusive processes involving heavy quarks and diffractive excitation into heavy quark systems.

10261 (SLAC-PUB—4140) **Toponium-Z^0 mixing.** Franzini, P.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1986. Contract AC03-76SF00515. 7p. (CONF-860736—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003265.

From SLAC summer institute on particle physics; Stanford, CA, USA (29 Jul 1986).

The subject of Z^0-toponium interference is briefly reviewed. The qualitative features of the Z^0 mixing with one t anti t state are discussed. Effects of mixing with the full t anti t spectrum, of the smearing due to beam spread, and of different potentials, are then shown.

10262 (SLAC-PUB—4147) **Kaon decay amplitudes using staggered fermions.** Sharpe, S.R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1986. Contract AC03-76SF00515. 7p. (CONF-8609142—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003668.

From Lattice gauge theory meeting; Upton, NY, USA (15 Sep 1986).

A status report is given of an attempt, using staggered fermions to calculate the real and imaginary parts of the amplitudes for $K \to \pi\pi$,. Semi-quantitative results are found for the imaginary parts, and these suggest that ϵ' might be smaller than previously expected in the standard model.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 10275, 10303, 10392

10263 (DOE/ER/40048—183) **Parity and time reversal violation in nuclei.** Adelberger, E.G. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1986. Contract AC06-81ER40048. 12p. (CONF-8610176—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003139.

From 5. international school on neutron physics; Alushta, USSR (20 Oct 1986).

The current status of investigations into parity and time-reversal violation in nuclei is reviewed. The author focuses on the P-odd NN interaction and its use as a probe of the weak interaction. This approach uses reactions involving light nuclei where structural models allow a connection between observed P-odd effects and the underlying NN interaction. 6 refs., 7 figs.

10264 (IPNO-TH—85-54) **Chiral symmetry aspects in supersymmetric confining gauge theories.** Knecht, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1985. 98p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750773.

We provide a detailed analysis of the interplay between chiral symmetry and supersymmetry within the context of supersymmetric confining gauge theories. We describe a general method leading to exact results on quark mass dependences of physical quantities such as bound-state masses, bilinear condensates,... We also establish the commutation relations satisfied by the supersymmetric and chiral charges in presence of the soft breaking due to quark masses. We show that, if the chiral limit is unique, the global SUsub(L)(Nsub(f)) x SUsub(R)(Nsub(f)) symmetry is not spontaneously broken. If this limit is not unique, a spontaneous breakdown of the axial symmetry is allowed, but only at the cost of a simultaneous breakdown of the vector symmetry.

6454 Field Theory

REFER ALSO TO CITATION(S) 10386, 10464

10265 (CEA-CONF—8467) **Supergravity models from superstrings.** Li, S.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Mar 1986. 6p. (CONF-8603119—12). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750775.

From 21. Rencontre de Moriond: strong interactions and gauge theories conference; Les Arcs, France (16 Mar 1986).

A brief review (mainly for the experimentalists) on how the four-dimensional supergravity models are obtained from the superstrings through a truncation mechanism is presented.

10266 (DOE/ER/40273—1) **Research in theoretical nuclear physics: Progress report, March 1, 1985-February 28, 1987.** Robson, D. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1987. Contract FG05-86ER40273. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003315.

The results obtained using a relativistic quark model with pions and results on the charge dependence of nucleon-nucleon interactions are significant steps in establishing the quark model as a calculable theory of hadrons with very few parameters. Results obtained in Lattice Gauge calculations are reported. The results obtained with hadronic model calculations are discussed.

10267 (IFVE-OTF—85-152) **Relativistic string theory. Part 3. Perturbation of one-zone string configurations.** Pron'ko, G.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700180.

Submitted to the journal Theor. Math. Phys. .

This paper continues studying the relativistic string theory. With the help of perturbation of the simplest one-zone string configuration P-there have been obtained the region of variation for action-type variables which discribe the internal degrees of freedom of string. The possibility of Lorentz invariant quantization of the string in four-dimensonal space is also discussed. 5 refs.

10268 (INIS-mf—10512, pp 79) **Extended BRS symmetry and axial gaugings.** Gaigg, P.; Rebhan, A.; Schweda, M.; Piguet, O. (Technische Univ., Vienna, Austria. 1. Inst. fuer Theoretische Physik; Geneva Univ., Switzerland. Inst. de Physique Theorique). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10269 (INIS-mf—10512, pp 79) **Gauge independent threshold effects in massive gauge theories .** Kreuzer, M.; Kummer, W. (Technische Univ., Vienna, Austria. 1. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10270 (INIS-mf—10512, pp 80) **Momentum subtraction scheme and the background field method.** Rebhan, A. (Technische Univ., Vienna, Austria. 1. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10271 (INIS-mf—10512, pp 81) **Confinement in supersymmetric QCD.** Faber, M.E.; Feilmair, W.; Markum, H. (Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10272 (INIS-mf—10512, pp 81) **SU(3) color multiplets and the temperature phase transition in the lattice QCD.** Faber, M.E.; Feilmair, W.; Markum, H.; Meinhart, M. (Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik; Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Radiumforschung und Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10273 (INIS-SU—357, pp 13-18) **Infrared asymptotics and Dyson-Schwinger equations for the gauge-invariant spinor Green function in quantum electrodynamics.** Skachkov, N.B.; Solovtsov, I.L.; Shevchenko, O.Yu. 1985. NTIS (US Sales Only), PC A05/MF A01. File Number DE87780028. (JINR-N—10-85).

In JINR rapid communications. Collection.

The Dayson-Schwinger equations for the gauge-invariant (G.I.) spinor Green function are derived for an Abelian case. On the basis of these equations as well as the functional integration method the behaviour of the G.I. spinor propagator is studied in the infrared region. It is shown that the G.I. propagator has a singularity of a simple pole in this region. 9 refs.

10274 (IPNO-TH—85-23) **Extended PCAC in supersymmetric confining gauge theories.** Knecht, M.; Stern, J. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). May 1985. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750783.

In SUSY-QCD the chiral symmetry breaking effects due to the sub(s))quark masses m_1...msub(N.f) are conveniently described by an algebraic extension of PCAC and PCVC relations. The latter is shown to lead i) to a general formula for the mass M of any bound state (a particular case was given previously) relating its small (s) quark-mass behaviour to the mean values of the chiral-symmetry generators and, ii) to relations connecting matrix elements of the axial and vector charges. If the chiral limit of the vacuum is unique (i.e. independent of (s) quark mass ratios), SUsub(L)(Nsub(f)) x SUsub(R)(Nsub(f) remains unbroken and the representation content of certain massless states may be fixed. Alternatively, axial-symmetries could break down spontaneously, only if SUsub(V)(Nsub(f)) breaks too, implying an additional vacuum degeneracy not arising from this spontaneous breakdown.

10275 (IPNO-TH—86-25) **Consistently truncated open superstring.** Aulakh, C.S. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Mar 1986. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750780.

Starting from the Kazama-Neveu-Nicolai-West action for the open superstring we obtain, by a consistent truncation, the minimal gauge invariant action for the Neveu-Schwarz sector. For the Ramond sector the "(k, k+1) form" fields, which are not eliminable without the introduction of non-localities, contain Goldstino modes involved in the Higgs effect by which fermions acquire a mass. In both the NS and the R sector the Gliozzi-Olive-Scherk projection operators must, for consistency, be modified to include a dependence upon the ghosts for the world-sheet supersymmetry.

10276 (ITP—85-15-E) **Zero-mode effects in the lattice thermodynamics of massless Bose field.** Gorenstein, M.I.; Lipskikh, S.I.; Sorin, A.S. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1985. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700181.

The thermodynamics of free massless Bose field on a lattice is discussed. The coefficients characterizing the finite size effects are obtained. The use of these coefficients in the Yang-Mills thermodynamics allows one to make Monte-Carlo calculations, carried out on the different size lattices, self-consistent. 6 refs.; 1 fig.; 1 tab.

10277 (KFTI—84-4) **On the collision integrals regularization in the Lorentz quantum model.** Ivashin, A.P.; Tsukanov, V.D. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1984. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700182.

Closed equation for the collision integral in the Lorentz quantum model is derived. Divergent diagrams are separated out in the decomposition in density. The procedure of divergency removing is indicated and regularized expressions for the collision integral in the two-dimensional case are derived. 5 refs.; 1 fig.

10278 (KMU-HEP—85-06) **Saddle-points of a two dimensional random lattice theory.** Pertermann, D. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic)). Jul 1985. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700183.

A two dimensional random lattice theory with a free massless scalar field is considered. We analyse the field theoretic generating functional for any given choice of positions of the lattice sites. Asking for saddle-points of this generating functional with respect to the positions we find the hexagonal lattice and a triangulated version of the hypercubic lattice as candidates. The investigation of the neighbourhood of a single lattice site yields triangulated rectangles and regular polygons extremizing the above generating functional on the local level.

10279 (KMU-HEP—85-07) **Lattice calculation in 1+1 dimensional QCD by the Hamiltonian ensemble projector Monte-Carlo method.** Hellmund, M. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic)). Jul 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700184.

The SU(2) gauge theory coupled to one unflavored fermion in 2 dimensions is studied on the lattice by a local Hamiltonian Monte-Carlo method. The vacuum energy, the quark condensate and the correlation function of the lightest meson are measured. For massless quarks the chiral symmetry is unbroken as expected in the continuum. A vanishing condensate is found and the meson mass is determined.

10280 (NUB—2664) **Phenomenological aspects of supersymmetry and supergravity.** Arnowitt, R.; Chamseddine, A.H.; Nath, P. (Northeastern Univ., Boston, MA (USA). Dept. of Physics). 1984. 3p. (CONF-840757—41). Department of Physics, Northeastern University, Boston, MA 02115. File Number TI87900315.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

Unified models based on N = 1 Supergravity possess the novel feature that the spontaneous breaking of SU(2) x U(1) is triggered by the spontaneous breaking of Supergravity. This phenomenon relates the mass scale of the two breakings i.e., one finds the gravitino mass m_s ~ M/sub W/, thus establishing a link between the gravitational and the electro-weak interactions. The N = 1 Supergravity unified models predict a variety of new phenomena in the low energy domain and we discuss some of these in the following.

10281 (SLAC-PUB—4070) **Twisted strings and orbifolds.** Bagger, J.A. (Institute for Advanced Study, Princeton, NJ (USA); Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Aug 1986. Contract AC03-76SF00515. 6p. (CONF-860701—59). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003272.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

Orbifold compactifications provide a practical approach to string symmetry breaking. They have the potential to bridge the gap between string theory and the physics of the standard model. 7 refs., 5 figs.

65 PHYSICS II

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 10670

10282 (BNL—38867) **Nuclear physics in the 1990's.** Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). Oct 1986. Contract AC02-76CH00016. 52p. (CONF-861028—2-Vugraphs). NTIS, PC A04. File Number DE87003214.

From American Physical Society Nuclear Physics Division meeting; Vancouver, Canada (9 Oct 1986).

The report consists of a series of transparencies. The focus of this talk was a review of strong interactions of strange and antibaryon probes of the nucleus. The review is divided into 8 sections. These are (1) two body amplitudes, (2) quark/gluon versus meson exchange descriptions of strange particle interactions, (3) strange particles in nuclear physics, (4) Drell-Yan processes and structure functions in the nucleus, (5) using K^+-nucleus elastic and total cross sections as a test of partial deconfinement, (6) nuclear physics with antinucleons, (7) antiproton induced reactions on nuclei, and (8) strangeness production in antiproton-nucleus annihilation.

10283 (CEA-CONF—8363) **Summary of the workshop: towards 4π physics.** Ngo, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Dec 1985. 23p. (CONF-851299—2-Summ.; CEA-DPH-N-S—2324). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750759.

From Workshop on 4.... physics; Grenoble, France (16 Dec 1985).

This summary is not intended to give an extensive review of all what has been said during the three days about technics, experiments and theories. It will be rather a brief and simple overview of what I felt during the meeting while listening to the different talks, discussions and participating to the round tables which were also a very important part of the workshop and contributed a lot to its success. This summary will be organized as follows: in a first part I shall briefly describe the basic problems that one is faced with "exclusive" measurements. Finally, we shall briefly review some of the theoretical problems existing at intermediate bombarding energies since any experiment would initially rely heavily on theoretical considerations.

10284 (CONF-861193—1) **Evaluating nuclear data uncertainty: Progress, pitfalls, and prospects.** Peelle, R.W. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002420.

From IAEA specialists' meeting on covariance methods and practices in the field of nuclear data; Rome, Italy (17 Nov 1986).

The reasons for including variance-covariance information in evaluated nuclear data files are reviewed. Accomplihments and obstacles in meeting these needs are identified. The capability to develop and utilize evaluated cross-section covariance files has been largely demonstrated, but comprehensive files of soundly based covariance data remain to be evaluated and not all types of cross-section data have yet been included. The status of the ENDF-VI covariance formats is discussed. Priorities are suggested for further development. Most effort should be concentrated to fully develop the capability to estimate the nuclear data uncertainties in quantities calculated for a broad energy spectrum. 12 refs.

10285 (IAEA-NDS—0-Rev.86/7) **Index to the IAEA-NDS-documentation series.** Lemmel, H.D. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Jul 1986. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700305.

This index lists the current versions of the IAEA-NDS-documents which summarize contents and formats of nuclear data libraries available from the IAEA Nuclear Data Section.

10286 (IAEA-NDS—7-Rev.86/7) **Index of data libraries available on magnetic tape from the IAEA Nuclear Data Section.** Lemmel, H.D. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Jul 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700306.

This document lists more than 80 nuclear data libraries and some atomic data libraries together with references that give more detailed information about these libraries. All data and documentation references are available upon request from the IAEA Nuclear Data Section, free of charge.

10287 (INDC(NDS)—179/G, pp 147-156) **Comparison of two fine group cross-section libraries resulting from the ENDF/B-V dosimetry file and gas file (version 1 and version 2).** Nolthenius, H.J.; Verhaag, G.C.H.M. Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

Some results are presented for the comparison of two versions of the ENDF/B-V dosimetry file. The comparison is made for a fine group structure of the SAND-II type. 2 refs, 12 figs, 1 tab. The work has been carried out under contract to the European Commission and has been financed by JRC.

10288 (JINR—E-1-85-524) **Study of nuclear effects in nucleon structure functions up to and beyond the kinematic limit.** Baranov, S.P.; Bardin, D.Yu.; Cvach, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy; AN SSSR, Moscow. Fizicheskij Inst.). 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700481.

An experiment on deep inelastic muon nucleon scattering is proposed to carried out in order to study the x-dependence (where x is the Bjorken variable) of nucleon structure functions and their ratios over a range of squared four-momentum transfers $Q^2=50$-200 GeV^2 and $x=0.4$-2.0. Such measurements performed on a number of nuclei with atomic weights from 2 to 207 would provide new information for detailed studies of the EMC effect and tests of many models explaining the x behaviour of the nucleon structure functions and their ratios. The measurements will be decisive for the proof that a quark-parton model of the nucleus describes adequately nuclear structure probed at high energies. The upgraded high luminosity spectrometer with improved resolution in transferred energy will be used for the measurements. 31 refs.; 21 figs.; 1 tab.

10289 (KEK—84-20, pp 285-297) **Experimental plan using heavy ion beams at AGS synchrotron.** Nagamiya, Shoji. (Tokyo Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

In this talk our experimental program using high-energy heavy ion beams at the AGS synchrotron at Brookhaven National Laboratory is described. Current hopes and expectations for nuclear matter at high density and high temperature are discussed. Then, our goals and set-ups for the 1986 experiment using 15 GeV/nucleon S beams are described.

10290 (KEK—84-20) **Proceedings of the KEK international workshop on 'nuclear physics in GeV region'.** Nakai, K.; Sekimoto, M. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan); Tokyo Univ. (Japan)). Feb 1985. 404p. (CONF-8411279—). NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048.

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Separate abstracts were prepared for the individual papers of this conference. (DWL)

10291 (LBL—22248) **Quantum theory and the physicists' conception of nature: Philosophical implications of Bell's theorem.** Stapp, H.P. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 31p. (CONF-8609201—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002575.

From Conference on the world view of contemporary physics: is there a need for a new metaphysics?; Fort Collins, CO, USA (25 Sep 1986).

Philosophical aspects of quantum theory are discussed and compared with the classical viewpoint. 17 refs. (DWL)

6511 Experimental Techniques

10292 (IAEA-NDS—79-Rev.0) **Program PLOTC4 (Version 86-1). Plot evaluated data from the ENDF/B format and/or experimental data which is in a computation format.** Cullen, D.E. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Sep 1986. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700307.

Experimental and evaluated nuclear reaction data are world-wide compiled in EXFOR format and ENDF format, respectively. The computer program PLOTC4 described in the present document plots data from both formats; EXFOR data must be converted first to a "computation format". The program is available cost free from the IAEA Nuclear Data Section, upon request.

10293 (IAEA-NDS—80-Rev.0) **Program X4TOC4 (Version 86-1). Translation of experimental data from the EXFOR format to a computation format.** Cullen, D.E. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Sep 1986. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700308.

Experimental nuclear reaction data are world-wide compiled in EXFOR format. The computer program X4TOC4 described in the present document translates data from the rather flexible EXFOR format to the more rigid "computation format" which is suitable for input to further computer processing of the data including graphical plotting. The program is available cost free from the IAEA Nuclear Data Section, upon request.

10294 **REAC nuclear data libraries.** Mann, F.M.; Lessor, D.E.; Pintler, J.S. (Hanford Engineering Development Lab., Richland, WA 99352). pp 207-210 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The activation code REAC requires two nuclear data libraries, one containing multigroup reaction cross sections and the other containing decay data. Cross sections for over 300 isotopes are included in the cross section library, resulting in over 6000 reactions. Over 90% of the stable isotopes and all unstable isotopes with half lives greater than 5 years and masses less than 220 amu are included. All isotopes reached by the reactions in the cross section libraries are included in the decay library.

10295 **Delayed neutron spectra and intensities from evaluated precursor data.** England, T.R.; Brady, M.C.; Wilson, W.B.; Schenter, R.E.; Mann, F.M. (Los Alamos National Lab., Los Alamos, NM). pp 739-742 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Recently evaluated and model estimated precursor data are used with preliminary ENDF/B-VI fission yields to calculate total and time-group ν-bar/sub d/ and spectra.

10296 **New neutron cross sections for fusion materials studies.** Greenwood, L.R.; Smither, R.K. (Argonne National Lab., Argonne, IL). pp 163-166 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron cross sections are being developed for a variety of fusion-related applications including neutron dosimetry, fusion plasma diagnostics, the activation of very long-lived isotopes, and high-energy accelerator neutron sources.

10297 **Delayed neutron data from TRISTAN.** Warner, R.A.; Reeder, P.L. (Pacific Northwest Lab., Richland, WA 99352). pp 701-705 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Half-lives and P/sub n/ values are presented for 38 precursors among the low yield fission products. P/sub n/ values are based on a beta-neutron coincidence technique.

10298 **The WNR/PSR facility: Neutron physics capabilities from sub-thermal to 800 MeV.** Lisowski, P.W.; Wender, S.A.; Auchampaugh, G.F. (Los Alamos National Lab., Los Alamos, NM 87545). pp 1245-1257 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The Weapons Neutron Research facility (WNR) is a versatile pulsed neutron source used in a variety of research programs ranging from fundamental neutron properties with ultra cold neutrons to medium energy charge exchange reaction studies. Here the authors describe the WNR facility and the improvements presently in progress as the Proton Storage Ring (PSR) becomes operational.

10299 **Direct mass measurements in the light neutron-rich region using a combined energy and time-of-flight technique.** Pillai, C.; Swenson, L.W.; Vieira, D.J.; Butler, G.W.; Wouters, J.M.; Rokni, S.H.; Vaziri, K.; Remsberg, L.P. (Los Alamos National Lab., Los Alamos, NM 87545). pp 1383-1387 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Of approximately 300 new atomic masses reported since 1975, the most important measurements taken to test atomic mass models have been those involving a concentrated set of measurements that extend far from beta-stability. Two excellent examples are the isotopic series of mass measurements carries out on the alkali elements and the alpha-decay chain Q-value measurements originating from /sup 176,178/Hg/sup 3/. Both provided extensive sets of new data that helped to reveal systematic deficiencies in a variety of atomic mass models. But extensive as these measurements were, each was limited by what could be measured (i.e., a particular isotopic sequence or a particular decay chain). In the experiment described here, the authors attempted to further extend mass measurement capabilities by developing a more general approach in which whole array of nuclei that lie far from stability can be measured simultaneously, independent of their N or Z. The authors demonstrate that direct mass measurements can be performed for fast recoiling nuclei by using a combined energy and time-of-flight technique.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

10300 **(DOE/ER/10423—T3) Nuclear structure studies with pions and light ions: Progress report for the period June 1, 1984-May 31, 1987.** Dehnhard, D. (Minnesota Univ., Minneapolis (USA)). Nov 1986. Contract AC02-79ER10423. 75p. NTIS, PC A04/MF A01. File Number DE87002825.

Pion and proton scattering experiments were done on a variety of nuclei at the Los Alamos Meson Physics Facility. The data were used to test nuclear structure models and models of the pion-nucleus interaction, as well as assumptions about the basic nucleon-nucleon interaction. Included in this report are descriptions of completed work, work in progress, and a list of publications. 63 refs., 24 figs., 1 tab. (DWL)

10301 **(IPNO-DRE—85-14) Experimental search of non strange narrow isovector dibaryons.** Tatischeff, B.; Berthet, P.; Combes-Comets, M.P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 54p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87750733.

Missing mass spectra from ^{3}He(p,d)X at Tsub(p)=.75 GeV (thetasub(lab) = 22°, 32° and 40°) and Tsub(p) = .925 GeV (thetasub(lab) = 30°, 40°) have been measured. Missing mass spectra from p(^{3}He, d)X at T_3sub(He) = 2.7 GeV and thetasub(lab)=18° have also been measured. The experiments have been carried out with a high missing mass resolution in order to detect possible narrow structures associated with B=2, T=1 quantum numbers. Such structures have been found whose masses and widths are given in the text. The masses of the narrow structures are shown to agree with a rotational like mass formula $M=M_0 + M_1 J(J+1)$, J being the associated spin. The observed peaks might be related to six quark states.

10302 (KEK—84-20, pp 270-284) **Experiments using beams of unstable nuclear isotopes. Interaction cross sections and the radii of He isotopes.** Tanihata, Isao. (Tokyo Univ., Tanashi, Japan. Inst. for Nuclear Study). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Secondary beams of ^{3}He, ^{4}He, ^{6}He, and ^{8}He were produced through the projectile fragmentation of 800 MeV/nucleon ^{11}B primary. Interaction cross sections(σ sub(I)) of all He isotopes on Be, C, and Al targets were measured by a transmission-type experiment. The interaction nuclear radii of He isotopes, R(He) = $\sqrt{}(\sigma/\pi)$ - R(T) where R(T) is of the target nucleus, have been deduced from the present σ sub(I) and the known σ sub(I) of ^{4}He + ^{4}He reactions.

10303 **(LA-UR—86-3859) Measurement of parity nonconservation in the proton-proton total cross section at 800 MeV.** Bowman, J.D. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8609151—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002905.

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A report is made of a measurement of parity nonconservation in the transmission of 800-MeV longitudinally polarized protons through an unpolarized, 1-m liquid-hydrogen target. The dependence of transmission on beam properties was studied to measure and to correct for systematic errors. The measured longitudinal asymmetry in the total cross section is A/sub L/ = [+2.4 +- 1.1 (statistical) +- 0.1 (systematic)] x 10^{-7}. 25 refs., 2 figs.

10304 **(UCRL—95365) Nuclear physics at PEP: First test and future plans.** Van Bibber, K.; Dietrich, F.S.; Melnikoff, S.O. (Lawrence Livermore National Lab., CA (USA)). Sep 1986. Contract W-7405-ENG-48. 49p. (CONF-8606241—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87000599.

From 3. Continuous Electron Beam Accelerator Facility summer school; Newport News, VA, USA (23 Jun 1986).

A test run of internal target nuclear physics at the PEP storage ring is described. The Time Projection Chamber (TPC-2γ detector) was used to detect the inelastically scattered electron and complete hadronic final state in the interaction of 14.5 GeV electrons with D_2, Ar and Xe gas targets. The data comprise mostly low-x low-Q^2 events, but some deep inelastic scattering as well. The future possibilities of a dedicated nuclear physics program at PEP are outlined. 15 refs., 25 figs.

10305 **Fusion product diagnostics on the princeton large torus.** Lovberg, J.; Strachan, J.; Heidbrink, W. (Princeton Plasma Physics Lab., Princeton, NJ). pp 245-248 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

With recent increases in bulk and tail ion temperatures on tokamaks such as the Princeton Large Torus, fusion product measurements have become a popular passive diagnostic for fusion physics. Solid-state charged-particle detectors which utilize 3.02 MeV proton emission from d(d,p)t thermonuclear reactions to determine local ion temperature gradients have been fabricated for use on PLT. Estimation of the radial ion thermal conduction during ohmic and RF wave-heated discharges should be possible using these data. Other applications of fusion product measurements from d(d,p)t, d(d,n)/sup 3/He, d(t,n)α, and d(/sup 3/He,p)α reactions are discussed.

10306 **Hydrogen fusion-energy reactions.** Brown, R.E.; Jarmie, N. (Los Alamos National Lab., Los Alamos, NM 87545). pp 45-57 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

At the Los Alamos Ion Beam Facility, the authors have installed a low-energy fusion cross section (LEFCS) apparatus specifically designed to measure cross sections to high accuracy for the various fusion-energy reactions among the hydrogen isotopes in the bombarding-energy range 10 to 120 keV. To date, they have completed and published a study of the D(t,α)n reaction, have finished data-taking for the D(d,p)T and D(d,/sup 3/He)n reactions, and have nearly finished data-taking for the T(t,α)nn reaction. Here the authors describe the LEFCS facility, present final and preliminary results for these reactions, and compare them with R-matrix calculations.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

10307 **(DOE/ER/03948—18) Hadronic interactions at intermediate energies: Progress report, February 1, 1986-January 31, 1987.** Mayes, B.W.; Hungerford, E.V. (Houston Univ., TX (USA). Dept. of Physics). Oct 1986. Contract AS05-76ER03948. 5p. (ORO—3948-18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003326.

This report consists of a series of selected abstracts of current research. The research topics reviewed are hyperon and antinucleon physics at the AGS, rare muon decays at LANL, and electromagnetic production of strangeness. A list of publications is included. 15 refs., 9 figs.

10308 (INIS-SU—362, pp 23-26) **Resonance character of the polarization energy dependence in elastic scattering of fast neutrons on carbon nuclei in the energy range from 15 to 17 MeV.** Benetskij, B.A.; Klyachko, A.V.; Lifanov, M.N.; Plotnikova, M.V.; Radev, R.P. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780037.

Kratkie Soobshcheniya po Fizike.; (No. 9).
In Experimental and theoretical physics. Collection.

In energy dependence of carbon nuclei analysing capacity in elastic scattering of fast neutrons peculiarity of resonance character with 16.1 MeV energy is noted that is connected with the entering state excitation in ^{13}C nucleus. 9 refs.; 1 fig.

10309 **(IPNO-T—85-05) Study of peripheral nuclear collisions by heavy ions. Mechanism development near the Fermi energy.** Borrel, V. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1985. 74p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750766.

The quasi-projectile fragments produced in peripheral reactions induced betwen Ar (44 MeV/u or 26.5 MeV/u) and different targets: ^{12}C, ^{58}Ni, ^{64}Ni, ^{103}Rh, ^{197}Au, have been detected; their atomic numbers and their masses have been identified: most of them are lighter than the projectile. Their energy spectra have been measured at the grazing angle: the main part of the cross section lies quite near the projectile velocity. The isotopic distributions measured for the fragments produced with the same projectile ^{40}Ar reflect some influence of the N/Z ratio of the target. This effect is greater for low incident energy. Thus, it seems that the projectile fragmentation is not the only mechanism involved in these reactions. We have compared the fragmentation peak, calculated in the framework of the Goldhaber model, with the experimental energy distribution: two other components appear: the first one looks like a tail of the fragmentation peak: it corresponds to fragmentation events following multiphonon excitation in the target. The second one exists only for the neighbours of the projectile: S, Cl. It is a narrow peak, higher in energy than the fragmentation one. It corresponds to transfer reactions towards unbound states of the target. The cross section for the production of potassium and calcium nuclei is sizeable: the direct transfer reactions are still possible at these energies.

10310 (KEK—84-20, pp 154-164) **Hypernuclear physics program with high-resolution π^+-beam.** Tanaka, K.H. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

In the past several years, hypernuclear research was performed almost exclusively by using recoil-less (K^-, π^-) reactions. Since the recoil momentum of hyperon produced by the recoil-less method is very small, only the substitutional states can be produced. For the advanced study of the hypernuclear structure, it is essential to produce various states of hypernuclei, especially the ground state. For this purpose, a new trial of producing hypernuclei via stopped-K^- absorption was measured. It has been further suggested to consider other production method such as (π^+, K^+) reaction through which a neutron in a nucleus can be converted to Λ with the recoil momentum of approximately 350 MeV/c. Three methods of hyper nuclei production were compared and it was found that the yield of the ground-state hypernuclei we can obtain in one hour will be 25, 3 and 3 for (π^+, K^+), (K^-, π^-), and stopped-K^- methods, respectively. Thus a program of the hypernuclear study by using (π^+, K^+) reactions at KEK-PS is proposed. The estimation of cost and man-power for this program was made and the results are summarized in this paper.

10311 (KEK—84-20, pp 125-138) **(K^-, π) reaction at low momentum transfer.** Brueckner, W.; Bertini, R.; Birien, P. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany, F.R.). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

This contribution is a review of (K, π) strangeness exchange experiments done at CERN during the past 7 years. Both Δ and Σ hypernuclear states have been observed. They are interpreted as the recoilless production of Hyperons in shell model states. The analysis of measurements on carbon and oxygen reveals information about the spin orbit splitting in Hypernuclei.

10312 (KEK—84-20, pp 139-153) **Formation of Σ hypernuclei from K^- absorption at rest. Present and future.** Iwasaki, M. (Tokyo Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

A successful result is described of Σ-hypernuclear formation experiment performed at KEK PS. A stopped-K^- method with an effective tagging was proven to be very efficient for the study of Σ hypernuclei. This method reveals the two hypernuclear peaks which correspond to the spin-orbit doublet of (p3/2) sub(Σ)- and (p1/2) sub(Σ)-. A preparation of new experiments with various targets for Σ and Δ hypernuclei is discussed.

10313 (LA-UR—86-3860) **The pion as a probe of nuclear structure: What we have and have not learned.** Bowman, J.D. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 16p. (CONF-860802—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002904.

From International nuclear physics conference; Harrogate, UK (25 Aug 1986).

Some experiments are reviewed that have used the pion as a probe of nuclear structure. The examples chosen use the qualitative features of the pion-nucleon interaction to study selectively certain aspects of nuclear structure. The talk is divided into five parts: (1) properties of the pion and the pion-nucleon interaction, (2) studies of the isospin mixing and neutron-to-proton matrix element ratios in inelastic scattering, (3) studies of isovector giant resonances in pion single-charge-exchange reactions, (4) the search for six-quark structures in the nucleus using pion double-charge-exchange reactions, and (5) concluding remarks. 20 refs., 12 figs.

10314 **Measurements and calculations of neutron scattering angular distributions over a wide mass and energy range.** Hansen, L.F. (Lawrence Livermore National Lab. (LLNL), Livermore, CA 94550). pp 83-95 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron elastic and inelastic differential cross sections for targets between /sup 9/Be and /sup 239/Pu at energies, $E > 14$ MeV have been measured using the Livermore and Ohio University neutron time-of-flight facilities. The authors review here the data and the analyses based on two local microscopic optical potentials from previous work. The results are also compared with calculations using global potentials. Coupled channel formalism has been used in the analysis of targets with strong deformations, such as Be, C, Ta, and actinides. The value of the microscopic optical potentials as a tool to predict elastic and inelastic neutron cross sections over a wide mass and energy range is discussed. The need for neutron measurements up to higher energies and their analysis in conjunction with (p.p) and charge exchange (p,n) data is addressed.

10315 **Photon production cross section measurements for Ta and Be.** Gould, C.R.; Dave, J.; Mitchell, G.E.; Ramakrishnan, P.; Auchampaugh, G.F.; Little, R.C.; Wender, S.A. (North Carolina State Univ., Raleigh, NC). pp 139-143 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Gamma-ray production cross sections have been measured in the 2-25 MeV energy range for Ta and Be using the 0-100 MeV white neutron source facility WNR at Los Alamos. Calculations of neutron induced backgrounds are discussed. Results for Ta are compared with previous measurements from ORELA.

10316 **Gamma-ray production cross sections for alpha-particle induced reactions on /sup 19/F and /sup 23/Na.** Norman, E.B.; Lesko, K.T.; Chupp, T.E.; Schwalbach, P.; Faccio, M.A. (Nuclear Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). pp 981-984 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Production cross sections have been measured for γ-ray lines excited in α-particle bombardment of a NaF target beam energies from 4.5. to 26 MeV.

10317 **Double differential neutron emission cross sections of /sup 10/B and /sup 11/B at 6, 10 and 14 MeV and of /sup 6/Li, /sup 7/Li and /sup 12/C at 14 MeV.** Drosg, M.; Lisowski, P.W.; Hardekopf, R.A.; Drake, D.M.; Treitl, K. (Los Alamos National Lab., Los Alamos, NM). pp 145-149 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Neutron emission spectra of /sup 10/B and /sup 11/B were measured at 6, 10, and 14.1 MeV and those of /sup 6/Li, /sup 7/Li and carbon at 14.1 MeV using time-of-flight techniques. Absolute double differential cross sections were obtained by using scattering from hydrogen as a cross section reference. Integration over energy ranges and solid angle yielded integrated elastic and total neutron emission cross sections. At 6 and 10 MeV excellent agreement with total cross section data is found; at 14.1 MeV the new data tend to be higher than expected. The biggest error source in the continuous spectra stems from uncertainties in the input library (ENDF/B-V) of the Monte Carlo correction for multiple scattering. In particular, the library for /sup 11/B appears to be very unrealistic, with a total elastic cross section at 14.1 MeV which should be higher by 50%.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

10318 (IAE—1976/E-4/PL/A) **Evaluation of the cross-sections for the ^{28}Si/n,p/^{28}Al and the ^{181}Ta/n,2n/ ^{180}Ta reactions.** Adamski, L.; Herman, M.; Marcinkowski, A. (Institute of Atomic Energy, Otwock-Swierk (Poland)). 1983. 36p. Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

This paper contains an evaluation of two reaction cross-sections: ^{28}Si/n,p/^{28}Al (from threshold to 22 Mev) and ^{181}Ta/n,2n/ ^{180}Ta (from threshold to 24 Mev). In the second case the reaction populating the metastable ^{180}sup(m)Ta (8.1sup(h) half life) is separately evaluated. In the Appendix the results of own measurements of the cross-section in the energy range 13.4 - 15.4 Mev are given.

10319 (INDC(GDR)—038/L) **Description of file 1402 for silicon for the library "BROND". Revision of MAT 2015 and integral data tests.** Hermsdorf, D. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Aug 1986. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87700212.

File 1402 for silicon has been evaluated for the library BROND maintained at the Nuclear Data Centre (CJD) at FEI Obninsk. Neutron nuclear data for silicon are of high importance for practical applications in dosimetry, shielding, geology and for the investigation of radiation damage effects in silicon as an essential component of contemporary nuclear instrumentations. The file includes most recent results from nuclear reaction theory and experiments. 35 refs, 6 figs, 10 tabs.

10320 **(IPNO-DRE—86-01) Production and identification of very exotic nuclei.** Pougheon, F. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1986. 25p. (CONF-860158—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750786.

From 25. international meeting on nuclear physics; Bormio, Italy (20 Jan 1986).

New very exotic nuclei have been produced by fragmentation of the projectile at intermediate energy at GANIL. They have been identified through time of flight and ΔE-E measurements after a magnetic separation with the 0° LISE spectrometer. New neutron rich isotopes have been identified up to Z = 26 and evidence for the stability of the new series Tz = -5/2 has been shown. These results improve the knowledge of the neutron and proton drip lines.

10321 **(TRI-PP—86-64) Universal Gamow-Teller quenching in (n,p), (polarized p,polarized p′) and (p,n) reactions.** Haeusser, O. (Simon Fraser Univ., Burnaby, British Columbia (Canada); TRIUMF, Vancouver, British Columbia (Canada)). Jul 1986. 5p. (CONF-860741—21). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900171.

From International symposium on weak and electromagnetic interactions in nuclei; Heidelberg, F.R. Germany (1 Jul 1986).

Recent results obtained with the new medium resolution spectrometer facilities are presented. A preliminary analysis of the small-angle data was carried out with two objectives in mind. The first objective was an investigation of the suitability of the nucleon-nucleus interaction - as a substitute of the well-understood electroweak interaction - for deducing nuclear structure information. The second objective is concerned with spin-isospin excitations which provide the strongest and best understood features in the forward angle spectra. For the (p,p′) reactions it is shown that small instrumental background and spin-flip information are essential for a reliable determination of Gamow-Teller strength at low excitation. Finally, first (n,p) results from TRIUMF are discussed. In the examples chosen the (n,p) channel contains a large fraction of the Gamow-Teller sum rule, and a quenching factor can be defined in a meaningful way. 19 refs., 9 figs., 1 tab. (DWL)

10322 **Spin dependence of the coherent scattering lengths of /sup 27/Al and admixture of s- and d- partial waves.** Mughabghab, S.F. (Brookhaven National Lab., Upton, NY 11973). pp 971-975 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A long standing discrepancy between measurements and calculations of the sign of the incoherent scattering length is attributed to two sources: 1) spin dependence of the potential scattering radius and (2) identification of additional s-wave resonances at higher neutron energies. Detailed examination of the reaction /sup 27/Al (n→,γ) /sup 28/Al induced by thermal neutrons revealed that R/sup +/ - R/sub -/ = 0.32 +. 0.10 fm. Also shape fit analysis of the total cross section showed the presence of s-wave resonances at neutron energies 280, 386, 422, 491, 523, and 615 keV. One interesting outcome is the demonstration of the admixture of s- and d-wave partial waves in these resonances and the presence of a large d-wave neutron strength in the above energy region.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

10323 **(IPNO-DRE—83-31) Excitation of "M1 transitions" in inelastic proton scattering.** Djalali, C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750710.

The high selectivity of 201 MeV inelastic proton scattering at forward angles for exciting ΔL = 0 spin flip transitions is outlined by comparison with (e,e′) and 65 MeV (p,p′) measurements. A summary of the results obtained on the calcium isotopes, the N = 28 isotones, ^{88}Sr and ^{90}Zr is presented. The differences in the relative M1 strength distributions between the (p,p′) and the (e,e′) results are discussed. Preliminary results on ^{208}Pb are given; the "isoscalar" 1^+ state at 5.846 MeV is excited.

10324 **(IPNO-DRE—85-13) L = 0 spin flip transitions excited by 201 MeV proton inelastic scattering at forward angles.** Djalali, C.; Morlet, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 12p. (CONF-8506120—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750734.

From 4. international conference on nuclear reaction mechanisms; Varenna, Italy (10 Jun 1985).

The high selectivity of 201 MeV inelastic proton scattering at forward angles for exciting ΔL = 0 spin-flip transitions is outlined by comparison with (e,e′) measurements. The results obtained in ^{48}Ca, ^{88}Sr and ^{28}Si are discussed. In ^{28}Si, the quenching in the isoscalar channel is comparable to or even larger than that in the isovector channel, indicating the importance of configuration mixing as a quenching mechanism. A quantitative analysis of the differences in the relative M1 strength distributions observed in the (p,p′) and the (e,e′) experiments shows the importance of the orbital contribution in the excitation of M1 states with electromagnetic probes. The recently low lying collective 1^+ states observed by (e,e′) reaction in ^{154}Sm, ^{156}Gd and ^{164}Dy have been studied by (p,p′) scattering. Almost no spin-flip strength is observed therefore confirming that these states are mainly excited through the orbital term of the electromagnetic M1 operator.

10325 **High-resolution structural material (n,xγ) production cross sections for 0.2 < E/sub n/ ≦ 40 MeV.** Larson, D.C. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 71-81 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

An experimental program has been initiated at the Oak Ridge Electron Linear Accelerator (ORELA) to measure yields of individual gamma rays resulting from interactions of 0.2- to 40-MeV neutrons with elements of structural materials of interest both for applied needs and basic research. In this paper, the authors outline this program and present some cross-section results for /sup nat/Cr(n,xγ), /sup 56/Fe(n,xγ) and /sup 58/Ni(n,xγ). A good estimate of the total inelastic scattering cross section is obtained from the production cross section of the gamma ray corresponding to de-excitation of the first 2/sup +/ level in the even-even nuclides studied. In addition, cross sections for production of gamma rays resulting from tertiary reactions are measured, thus obtaining scarce cross-section information about these reactions.

10326 **Status of the parameters of the 1.15-keV resonance of /sup 56/Fe.** Perey, F.G. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 1523-1528 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Following the Antwerp Conference, a task force was appointed by the Nuclear Energy Agency Nuclear Data Committee (NEANDC) to investigate discrepancies in parameters of the 1.15-keV resonance of /sup 56/Fe. This task force has not completed its investigations. The status of various transmission and capture experiments is reviewed.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

10327 (CRN-PN—85-32) **Angular momentum effects in fusion reactions near the Coulomb barrier.** Duchene, G. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1985. 149p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750728.

Cross sections and γ-ray multiplicities have been measured for neutron evaporation channels in the reactions ^{16}O + ^{144}Nd, ^{37}Cl + ^{123}Sb, ^{64}Ni + ^{96}Zr and ^{80}Se + ^{80}Se leading to the compound system ^{160}Er at common excitation energies. In the near-barrier energy regime average angular momentum transfers depend dramatically on the asymmetry of the entrance channel. The results can be interpreted in terms of barrier fluctuations induced by target and projectile ground-state vibrations.

10328 (CRN-PN—85-34) **Study of reaction mechanisms in $^{40}Ar+^{68}Zn$ interaction at 14.6 and 27.6 MeV/N.** Rami, F. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1985. 122p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87750727.

The competing mechanisms in the $^{40}Ar+^{68}Zn$ reaction have been investigated at two bombarding energies: 14.6 and 27.6 MeV/nucleon. Mass, charge and energy spectra of the reaction products have been measured in a large angular range (3° <= theta <= 40°). The results show that important changes occur in this energy region. At 14.6 MeV/nucleon the production of the projectile-like fragments results mainly from deep inelastic and direct nucleon transfer reactions; while at 27.6 MeV/nucleon a strong component corresponding to process similar to projectile fragmentation is also observed. A distinction between the fragmentation process and direct transfer of few nucleons has been possible by analysing the linear momentum distributions of the detected fragments. The energy dependance of the fusion cross section indicates that this process should disappear for incident energies E/A > approximately 30 MeV/nucleon. The maximum temperature reached by the compound nucleus has been deduced i.e. Tmax approximately equal 7 MeV; this value is in agreement with recent theoretical predictions.

10329 (JINR—R-1-85-495) **Search for supernuclei in interactions of protons with photoemulsion nuclei at 250 and 70 GeV.** Batusov, Yu.A.; Bunyatov, S.A.; Kostanashvili, N.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1985. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700254.

The analysis of approximately 1.27 x 10^6 interactions of 250 and 70 GeV protons and secondary particles has yielded three candidates for supernuclei. These events possess a set of characteristic features a supernuclear decay: a large visible energy release Esub(vis) approximately 0.5-1.0 GeV, short ranges R = 2-4 μm. The kinematical analysis has shown that there is no contradiction in interpreting those events as supernuclear decays. However the formation of a supernucleus must be accompanied by the production of an associative charmed antiparticle. A candidate for the anti Ddeg meson decay was registered only in one event. So it is difficult to claim for sure that supernuclei have been observed. The upper limit of the supernucleus yield in pA-interactions in photoemulsion at 90% Cl is f sub(<= 3.1 x 10^{-6} per inelastic interaction at Esub(p) = 250 GeV and <= 3.1 x 10^{-5} at Esub(p) = 70 GeV. The estimation of the upper limit of the supernuclear yield in interaction of leading protons at Esub(p) approximately 50-100 GeV has been made: f sub(SF) <= 3.8 x 10^{-6}. The upper limit of the fraction of Λsub(c)sup(+) producing supernuclei in interactions of 250 GeV protons with Ag, Br nuclei has been estimated at 90% Cl:delta sub(Λsub(c))+ <= 4.0 x 10sup(-3) for delta (pA→Λsub(c)sup(+)) approximately A^1 and <= 8.7 x 10^{-3} for delta (pA → Λsub(c)sup(+)) approximately Asup(2/3). 23 refs.; 4 figs.; 2 tabs.

10330 **The /sup 63/Cu(n,2n)/sup 62/Cu and /sup 65/Cu(n,2n)/sup 64/Cu cross sections at 14.8 MeV.** Ghanbari, F.; Robertson, J.C. (Univ. of New Mexico, Albuquerque, NM). pp 179-182 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Measurements have been made of the Cu(n,2n)/sup 62/Cu and /sup 65/Cu(n,2n)/sup 64/Cu cross sections. Separated isotopic targets were irradiated with 14.8 MeV neutrons and the resulting /sup 62/Cu and /sup 64/Cu activities measured using both 4πβ-γ coincidence counting and by counting in coincidence the annihilation radiation produced following the β/sup +/ decay of /sup 62/Cu and /sup 64/Cu. The variations in the neutron flux and the neutron energy were measured during each single irradiation. Good agreement was obtained for the cross section values using the two methods. However, the deviation in the /sup 65/Cu(n,2n)/sup 64/Cu cross section measurements was significantly greater when the 4πβ-γ coincidence method was used than when the annihilation radiation were counted in the γ-γ coincidence system. The measurements were made relative to the /sup 56/Fe(n,p)/sup 56/Mn cross section. Values of 555 +. 9 mb and 978 +. 30 mb were obtained using a value of 109.9 mb for the iron cross section.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

10331 (DOE/ER/10494—T2) **Radioactive decay and nuclear structure studies: Progress report, covering the period October 1, 1985 through September 30, 1986.** Walters, W.B. (Maryland Univ., College Park (USA). Dept. of Chemistry). 1986. Contract AS05-79ER10494. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003312.

The results of a series of studies of nuclear structure performed at the on-line mass separator facility TRISTAN located at the High-Flux Beam Reactor at Brookhaven National Laboratory are reported. New data and interpretations are reported for the structure of /sup 130,131,132/Sb, /sup 139,141,143/Cs, ^{145}Ba, /sup 139,141,143/La, and ^{145}Pr. 22 refs., 23 figs., 1 tab.

10332 (INIS-SU—357, pp 19-25) **Correlations in gamma-quanta angular distribution at neutron capture in ^{117}Sn p-resonance region.** Alfimenkov, V.P.; Borzakov, S.B.; Mareev, Yu.D.; Pikel'ner, L.B.; Khrykin, A.S.; Sharapov, Eh.I. 1985. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number DE87780028. (JINR-N—10-85).

In JINR rapid communications. Collection.

An angular distribution and the experimental analysing power were investigated for the direct transition (Esub(γ)=9.3 MeV) in the $^{117}Sn(n, \gamma)$ reaction near the parity violating p-wave 1.33 eV resonance in order to obtain partial neutron widths with the total neutron momentum j=1/2 or j=3/2. The experiments were performed by the time-of-flight method at the IBR-30 reactor with the NaI(Tl) spectrometer. The results appeared to be inconsistent with any available at present theory. 12 refs.; 4 figs.

10333 (LPCC-T—85-01) **Semi-exclusive study of the reaction Ar + Ag at 35 A MeV.** Ployart, G. (Caen Univ., 14 (France). Lab. de Physique Corpusculaire). Jul 1985. 130p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750745.

The experiment was carried out at the GANIL and was the object of the first starting up of the hodoscope bound up with the lid of the reaction chamber NAUTILUS. Although the detection equipment was not planned for a detailed analysis of light (O-Ar) and fast nuclei (beam velocity), many indications converge to attribute their origin to a mechanism alike projectile fragmentation when it is not a matter of transfer. Furthermore, the lack at 35 A.MeV of evaporation residues from the quasi-complete fusion nucleus, still present at 27 A.MeV, shows that one has exceeded the maximum excitation energy bearable by the system. Most light particles spectra can be understood in term of evaporation from a nucleus more or less thermalised; for the others (fast alphas and lithiums detected in frontal collisions), one has to suppose a target transparency for some nucleons of the projectile. The main evaporation sources have considered are, for central collisions, the quasi complete fusion nuclei (before their dislocation into light fragments) and, for peripheral collisions, the quasi targets and quasi projectiles associated with spectator nuclei of the ablation model. In this last case, the consideration of the participant zone as an evaporating source of middle speed raises some difficulties.

10334 **Fast-neutron interaction with niobium.** Smith, A.B.; Guenther, P.T.; Poenitz, W.P.; Smith, D.L.; Whalen, J.F.; Howerton, R.J. (Argonne National Lab., Argonne, IL). pp 129-132 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Results of a comprehensive study of the interaction of fast neutrons with niobium are presented, including measurement and interpretation of neutron total, differential-scattering and radiative-capture cross sections. The experimental results are interpreted in the context of the optical-statistical model, with attention to the Fermi-surface anomaly. Experimental results, physical interpretations and rigorous statistical methods are used to provide a comprehensive evaluated nuclear data file suitable for use in a wide range of applied neutronic calculations.

10335 **Independent isomer yield ratio of /sup 90/Rb.** Reeder, P.L.; Warner, R.A.; Ford, G.P. (Pacific Northwest Lab., P.O. Box 999, Richland, WA 99352). pp 767-770 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The independent isomer yield ratio for /sup 90/Rb from thermal neutron fission of /sup 235/U has been measured by use of a new technique involving a pulsed reactor and an on-line mass spectrometer facility. The observed isomer yield ratio of 8.7 +. 1.0 is one of the largest ratios measured for a low energy fission process. However, a statistical model analysis shows that the average angular momentum (<J> = 4.5) deduced from this isomer yield ratio is consistent with average angular momentum for other products from low energy fission.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

10336 (INIS-SU—357, pp 69-76) **E0 transitions at ^{164}Tm decay. 0$^+$ states in ^{164}Er.** Adam, I.; Gons, Z.; Gromov, K.Ya.; Kononenko, G.A.; Islamov, T.A.; Kholmatov, A.Kh. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia; Joint Inst. for Nuclear Research, Dubna, USSR. Lab. of Nuclear Problems; Tashkentskij Gosudarstvennyj Univ., USSR). 1985. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number DE87780028. (JINR-N—10-85).

In JINR rapid communications. Collection.

Precision investigations of the conversion electron spectrum at the decay of ^{164}Tm have been performed using β-spectrographs with the constant homogeneous mgnetic field. Ten transitions of the E0 type have been found, among them four transitions between excited 0$^+$ states. Seven excited 0$^+$ levels have been found in ^{164}Er. Their properties have been analysed. 11 refs.; 3 figs.; 3 tabs.

10337 (IPNO-DRE—83-28) **βi/EC decay of ^{181}Au: γ-ray identification.** Braganca-Gil, F.; Porquet, M.G.; Bourgeois, C.; Kilcher, P; Parot, G.; Sauvage-Letessier, J.; Roussiere, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750763.

The β^+/EC decay of ^{181}Au has been studied with mass separated sources from the ISOCELE facility. Main γ-rays which belong to the ^{181}Au → ^{181}Pt decay have been identified from X-γ coincidence measurements. A rotational band built on the 1/2 -[521] Nilsson state has been developed up to the 7/2$^-$ state in ^{181}Pt.

10338 (JINR—E-1-84-408) **Asymmetry of πp meson emission in nucleus-nucleus collisions as a measure of ratio of the interacting nucleon numbers in target and projectile.** Bartke, J.; Ivanovskaya, I.A.; Mekhtiev, R.R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700211.

Experimental data on forward-backward asymmetry of π^- emission in (d, ^{4}He, ^{12}C) ^{181}Ta interactions at p/A=4.2 GeV/c are presented. The absolute value of the asymmetry coefficient of the inclusive π^- production in the nucleon-nucleon cms decreases as Asub(p)sup(-0.35) with the increasing atomic mass of projectile nucleus. A method of obtaining ratio of the numbers of participant nucleons of target and projectile, Nsub(t)/Nsub(p), through measuring the velocity of the symmetric pion emission system, is proposed. It has been found that Nsub(t)/Nsub(p) approximately Asub(p)sup(-0.73). 14 refs.; 5 tabs.; 3 figs.

10339 (LAFI—073) **Energy levels of sup(155)Eu studied by thermal neutron capture reaction.** Guseva, T.V.; Prokof'ev, P.T.; Bondarenko, V.A. (AN Latvijskoj SSR, Riga. Inst. Fiziki). 1985. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87700482.

The γ-ray and conversion electron spectra of ^{155}Eu from the (n, γ) reaction were studied using curved crystal spectrometers of GAMS 1, GAMS 2/3, β-spectrometer, BILL, and the pair spectrometer. γ-transition multipolarities have been determined in the energy interval of 40-1200 keV. The level scheme of ^{155}Eu has been deduced with 51 level, up to the 1.7 MeV excitation energy. These levels are depopulated via 140 transitions of 360 ones observed in γ-ray spectrum. The levels are grouped into 13 rotational bands of which 3/2$^-$(541), 1/2$^-$(550), 5/2$^+$(413)+Q_{20}, 3/2$^+$(411)+Q_{30} are entirelyew. The ΔK=0 type of E1 transitions are enhanced comparing with the ΔK=1 type of E1transitions. 32 refs.; 9 tabs.; 7 figs.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

10340 (GSI—86-29-Prepr.) **Review of experimental evidence for octupole deformation.** Zylicz, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1986. 14p. (CONF-8606130—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750319.

From International conference on nuclear structure, reactions, and symmetries; Dubrovnik, Yugoslavia (5 Jun 1986).

Experimental evidence for octupole correlations, which lead to octupole instability and octupole deformation of some nuclei, is illustrated through typical examples. Data are considered for both the 220<A<230 region and for a few medium mass nuclei.

10341 (INDC(GDR)—039/L) **Description of file 8201 for lead for the library "BROND".** Hermsdorf, D. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Aug 1986. 78p. NTIS (US Sales Only), PC A05/MF A01. File Number DE87700213.

File 8201 for natural lead has been evaluated for the library BROND maintained at the Nuclear Data Centre (CJD) at FEI Obninsk. The file has been specially designed for applications in fusion and hybrid reactor projects but also fulfils all data demands arising from thermal and fast reactor research. The data have been evaluated in an international co-operation between TU Dresden and CJD Obninsk based on independent investigations carried out in both institutions. It includes most recent results from nuclear reaction theory and experiments. 69 refs, 33 figs, 16 tabs.

10342 (IPNO-T—85-09) Contribution to the structure study of mercury isotopes with the (p,d) reaction. Grafeuille, S. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1985. 128p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750752.

The mercury isotopes were studied by means of the two pick-up reactions (p,d) and (p,t). Enriched targets of ^{204}Hg, ^{202}Hg, ^{201}Hg, ^{200}Hg, ^{199}Hg, ^{198}Hg and ^{196}Hg were bombarded by a 25 MeV proton beam from the Orsay MP tandem accelerator. Emitted particles were analyzed by a split-pole magnetic spectrometer. We present all the results (nearly 150 states) of the analysis of the (p,d) reactions. Our (p,d) and (p,t) study show new discontinuities around ^{200}Hg in systematics of mercury isotopes. Part of the results are compared to the U(5) limits of Interacting Bosons (and Fermions) Models. The light nuclei can be considered reasonably described but this could be somewhat fortuitous. (71 refs).

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

10343 (AECL—8844) Measured dependence of some effective cross sections on thermal neutron temperatures in the range -195 degrees C to 20 degrees C. Jones, R.T.; Okazaki, A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1985. 56p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87700253.

The variation of effective cross section in Maxwellian neutron distributions with temperatures in the range -195 degrees C to 20 degrees C have been measured for Usup(233), Usup(235), and Pusup(239) fission, and for Usup(238), Thsup(232), Cusup(63), Insup(115), Lusup(176), and Ausup(197) capture. Foil activation methods were used. Mnsup(55), which has known 1/v dependence, was used as the reference. The results, with some from previous measurements covering temperatures from 20 degrees C to 300 degrees C, are compared with suitable integrations of ENDF/B-V data. Except for Lusup(176) and Ausup(197) the results agree within the estimated uncertainties with the ENDF/B-V data.

10344 (CENBG—8524) Nuclear fission mechanism: contribution to the study of different means of nucleus fragmentation. Caitucoli, F. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). Jul 1985. 252p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE87750754.

Fission fragment mass and energy distributions and their correlations have been measured for a large number of fissioning systems with different Z and N parities: thermal neutron induced fission of ^{229}Th, ^{231}Pa, ^{232}U, ^{233}U, ^{235}U, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{241}Pu, ^{241}Am, ^{242}Am and spontaneous fission of ^{244}Cm. Cold fission has been studied while selecting fragmentations with final kinetic energies close to the maximum energy released in the reaction. For these fragmentations the potential energy surface around scission is expected to have a strong influence on the fission process. The mass distributions are strongly determined by two neutron shell closures in the heavy fragment: the N=82 spherical shell (together with the Z=50 spherical proton shell) and the N=88 deformed shell. In the case of odd Z fissioning systems the fragment mass distributions exhibit a fine structure effect with a periodicity of about 2.5 amu; we attributed this fine structure to different charge fragmentations.

10345 (CONF-850507—68) Measurement of the neutron spectra from the decay of the giant quadrupole resonance in ^{238}U. Countryman, P.J.; Griffioen, K.A.; Oremland, N.Z.; Van Bibber, K.; Yearian, M.R.; Calarco, J.R.; Woodworth, J.G. (Lawrence Livermore National Lab., CA (USA); Stanford Univ., CA (USA); New Hampshire Univ., Durham (USA). Dept. of Physics). 1985. Contract AM03-76SF00326. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003162.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

We have performed the coincidence experiments (α,α'f) and (α,α'nf) on ^{238}U for a beam energy E/sub α/ = 120 MeV and for α-scattering angles θ/sub α'/ = 9°, 15°, and 17°. The 9° and 17° data correspond to maxima in the angular distribution for the isoscalar giant quadrupole resonance, whereas the 15° data lie close to a minimum. Using a set of fission counters which covered roughly 80% of 4π, we were able to reject neutrons associated with fission in the (α,α'n) spectrum. We present a first look at these spectra. 9 refs., 3 figs.

10346 (INDC(CPR)—009/L) Fission cross section measurements around 14 MeV. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). Aug 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700255.

The report includes two separate papers. In one of them the U-235 fission cross section induced by 14.2 MeV neutrons was measured by the time correlated associated particle method and the value obtained is (2.078 +- 0.040) barn. In the other one the fission cross section ratio of U-238 to U-235 induced by 14.7 MeV neutrons was measured using the same method and the value obtained is sigmasub(f)(U-238)/sigmasub(f)(U-235)=0.565 +- 0.014. Refs, figs and tabs.

10347 (INDC(CPR)—009/L, pp 3-6) 14.2 MeV neutron induced U-235 fission cross section measurement. Li Jingwen; Shen Guanren; Ye Zongyuan; Li Anli; Zhou Shuhua; Sun Zhongfan; Wu Jingxia; Huang Tanzi. (Academia Sinica, Beijing, China. Inst. of Atomic Energy). Aug 1986. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700255.

In Fission cross section measurements around 14 MeV.

The cross section of U-235 fission induced by 14.2 MeV neutrons was measured by the time correlated associated particle method. The result obtained is (2.078 +- 0.040) barn. Comparison with other author's is also given. 10 refs, 4 figs, 1 tab.

10348 (INDC(CPR)—009/L, pp 7-10) 14.7 MeV neutron induced fission cross section ratio of U-238 to U-235. Li Jingwen; Zhou Shuhua; Liu Weiping; Ye Zongyuan; Yue Gang; Bai Xixiang. (Academia Sinica, Beijing, China. Inst. of Atomic Energy). Aug 1986. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700255.

In Fission cross section measurements around 14 MeV.

The fission cross section ratio of U-238 to U-235 induced by 14.7 MeV neutrons was measured by time correlated associated particle technique. The value obtained is sigmasub(f)(U-238)/sigmasub(f)(U-235)=0.565 +- 0.014. 9 refs, 4 figs,1 tab.

10349 (IPNO-DRE—84-40) Reaching the capacity of a composite nucleus for energy and spin containment. Jacquet, D.; Duek, E.; Alexander, J.M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750737.

The reaction 1080 MeV ^{40}Ar + ^{238}U has been studied via correlated fission fragments and He particles. Between 1/3 and 1/2 of the reaction cross section goes into fusion-like events to form composite nuclei excited to 500-800 MeV. The probability for such high energy containment drops dramatically for ^{40}Ar projectiles between 27 and 44 MeV/u. Evaporative He particles for fusion-like events (multiplicity approximately equal 1.5) have been found to arise predominantly from the massively excited composite nuclei.

10350 (IPNO-DRE—85-20) First evidence for the radioactive decay of ^{226}Ra by ^{14}C emission. Hourani, E.; Hussonnois, M.; Stab, L.; Brillard, L.; Gales, S.; Schapira, J.P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750785.

Using the magnetic spectrometer SOLENO and an intense ^{226}Ra source, first evidence for the radioactive decay of ^{226}Ra by ^{14}C emission was obtained leading to a measured branching ratio relative to α particles of (3.2 +- 1.6) x 10^{-11}. In addition, the decay of ^{223}Ra by ^{14}C emission, previously reported, was clearly observed and an upper limit was set for the emission of ^{34}Si from ^{241}Am.

10351 Mean fission neutron spectrum energies for /sup 252/Cf and fissile nuclides /sup 233/U, /sup 235/U, /sup 239/Pu and /sup 241/Pu. Holden, N.E. (Brookhaven National Lab., Upton, NY). pp 1467-1470 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC02-76CH00016.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The spectra of prompt fission neutrons are of interest for the study of the neutron emission mechanism as well as for their relevance to the practical problems of nuclear reactors. The mean neutron energy of the fission spectrum directly impact the interpretation of experiments on the average number of prompt neutrons released in a fission. In order to make efficiency corrections in the measurements of the number ratio of the fissile nuclides to /sup 252/Cf, the mean energy of each fission spectrum has been evaluated for these nuclides. There were not enough data available for the fissile nuclides to treat the problem of the dependence of the average energy of the fission spectrum on the incident neutron energy. In the case of /sup 235/U, the mean energy is larger than earlier measurements indicated because the neglect of the effects of multiple scattering lowered the mean energy results for those earlier experiments.

10352 Comparisons of four representations of the prompt neutron spectrum for the spontaneous fission of /sup 252/Cf. Madland, D.G.; Labauve, R.J.; Nix, J.R. (Los Alamos National Lab., Los Alamos, NM). pp 1445-1449 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The authors compare four representations of the prompt neutron spectrum for the spontaneous fission of /sup 252/Cf with recent differential and integral measurements.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 10231, 10231, 10232, 10232, 10245, 10279, 10301, 10319, 10328, 10334, 10341, 10461, 10463

10353 (ANU-P—939) Shell model calculations for neutron rich nuclei with A=35-41. Woods, C.L. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Nov 1985. 64p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87700205.

Shell model calculations are presented for neutron-rich nuclei in the mass region A=35-41 using two new interactions. The usefulness and reliability of the interactions are evaluated with particular emphasis on their predictions for netron-rich isotopes. The calculations are performed in a $0(h/2\pi)\omega$ basis space with active protons in the 1d5/2, 2s1/2 and 1d3/2 orbitals and active neutrons in the 1f7/2 and 2p3/2 orbitals.

10354 (BNL—38618) Proton-neutron interaction and nuclear structure. Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 33p. (CONF-8609190—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001378.

From 18. summer school on nuclear structure studies by means of nuclear reactions; Mikolajki, Poland (1 Sep 1986).

The pervasive role of the proton-neutron interaction in nuclear structure is discussed. Particular emphasis is given to its influence on the onset of collectivity and deformation, on intruder states, and on the evolution of subshell structure. The N/sub p/N/sub n/ scheme is outlined and some applications of it to collective model calculations and to nuclei far off stability are described. The concept of N/sub p/N/sub n/ multiplets is introduced. 32 refs., 20 figs.

10355 (BNL—38900) Neutron resonance averaging. Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). Oct 1986. Contract AC02-76CH00016. 19p. (CONF-8610176—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003195.

From 5. international school on neutron physics; Alushta, USSR (20 Oct 1986).

The principles of resonance averaging as applied to neutron capture reactions are described. Several illustrations of resonance averaging to problems of nuclear structure and the distribution of radiative strength in nuclei are provided. 30 refs., 12 figs.

10356 (CEA-CONF—8304) Inclusive and exclusive deep-inelastic electron scattering. Morgenstern, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Nov 1985. 13p. (CONF-8511163—2; DPH-N-S—2321). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750038.

From 4. Amsterdam miniconference; Amsterdam, Netherlands (26 Nov 1985).

In this talk, I will present some deep inelastic electron scattering experiments done recently at Saclay with the purpose of studying high momentum components in the nucleus, many body effects as correlations, exchange currents, and the electron-nucleon interaction inside the nuclear medium. For that purpose we have performed (e,e) and (ee'p) experiments. When we detect only the scattered electron, we get some average properties less sensitive to final state interaction; in ee'p measurements we are more specific.

10357 (CEA-CONF—8322) Dynamical evolution of hot and compressed nuclei. Tomasi, E.; Ngo, C.; Nemeth, J.; Barranco, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Jan 1986. 10p. (CONF-860158—4; DPh-N-S—2322). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750707.

From 25. international meeting on nuclear physics; Bormio, Italy (20 Jan 1986).

The evolution of hot and compressed nuclei has been investigated within the framework of a spherical time-dependent semiclassical model. Global and local equilibrium conditions have been explored. The dissipation effects on the stability of the nucleus are also discussed.

10358 (GANIL-P—86-05) Semi-classical dynamics of heavy-ion reactions. Gregoire, C.; Vinet, L.; Remaud, B.; Sebille, F.; Raffray, S. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1986. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750761.

We present a semi-classical approach of the heavy-ion collision theory in the intermediate energy domain (10-100 MeV incident kinetic energy per nucleon) based on the Vlasov equation and its extension - the Landau Vlasov equation - when the residual interaction is accounted for through a collision kernel. We use the coherent state set as an overcomplete basis for the decomposition of the nuclear phase space distributions. We show that the uniform approximation to the coherent state repartition in the phase space, provides semi-classical descriptions of nuclei at equilibrium which are the correct initial conditions of the Vlasov and Landau-Vlasov dynamical equations. In the slab geometry, we compare the results of the Vlasov equation with those of the TDHF theory for the crossing of a potential barrier and the collision of two slabs. We present sample results of three-dimensional calculations of heavy-ion collisions with a Skyrme self-consistent interaction and inclusion of the Coulomb interaction; the individual collisions being described by the Uehling-Uhlenbeck kernel. These calculations illustrate the incomplete fusion process for central collisions at 27 MeV/u incident energy and the onset of an abrasion-like process for more peripheral collisions at 35 MeV/u.

10359 (GSI—86-23-Prepr.) **Influence of ground state correlations on nuclear densities.** Hasse, R.W.; Friman, B.L.; Berdichevsky, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); McMaster Univ., Hamilton, Ontario (Canada). Dept. of Physics). Jul 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750304.

The effect of ground state correlations on the density distributions of nuclei is estimated in a semiclassical approximation. The occupation probability for a single-particle state in the correlated ground state is obtained by folding n(p,r), obtained from the semiclassical self energy, with Hartree-Fock single-particle wave functions. The shape of the charge density in ^{208}Pb agrees well with empirical data, although the bulk density is too low.

10360 (INDC(CPR)—8/L) **Systematics of excitation functions for (n, charged particle) reactions.** Zhao Zhixiang; Zhou Delin. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). Jun 1986. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700208.

On the bases of evaporation model considering the preequilibrium emission under some approximations, the analytical expressions including two adjustable parameters have been derived for excitation functions of (n, charged particle) reactions. Fitting these expressions to the available measured data, these parameters have been extracted and the systematic behaviour of the parameters have been studied. More accurate predictions than before could be obtained by using these expressions and systematic parameters. In the present work the neutron energy is considered up to about 20 MeV and the target mass region is $23 < A < 197$. 17 refs, figs.

10361 (INIS-mf—10512, pp 26) **Suppression of tensor force in separable models with rank 1.** Crepinsek, L.; Schwarz, K.; Zingl, H.F.K. (Maribor Univ., Yugoslavia; Graz Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10362 (INIS-mf—10512, pp 27) **Electromagnetic radii of the deuteron.** Crepinsek, L.; Schwarz, K.; Zingl, H.F.K. (Maribor Univ., Yugoslavia; Graz Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10363 (INIS-mf—10512, pp 29) **Influence of continuum states on the radial variation of the transfer form factors.** Leitner, W.; Staudt, G.; Oberhummer, H.; Preisinger, K.; Muether, H.; Pfeifer, W. (Tuebingen Univ., Germany, F.R. Fakultaet fuer Physik; Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik; Tuebingen Univ., Germany, F.R. Inst. fuer Theoretische Physik; Alte Kantonsschule Aarau, Switzerland). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10364 (INIS-mf—10512, pp 82) **Optical alpha particles potentials for transfer reactions.** Welte, S.; Walz, M.; Leitner, W.; Hauser, H.J.; Staudt, G. (Tuebingen Univ., Germany, F.R. Physikalisches Inst.). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10365 (INIS-mf—10512, pp 83) **Coulomb modification of separable nucleon-alpha potentials.** Stadler, A.; Schweiger, W.; Zankel, H.; Leeb, H. (Graz Univ., Austria. Inst. fuer Theoretische Physik; Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10366 (INIS-mf—10512, pp 84) **Momentum space calculations for the N-d scattering below the breakup threshold.** Berthold, G.H.; Zankel, H. (Graz Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10367 (IPNO-TH—85-49) **Momentum distribution of non-interacting fermions enclosed in a box.** Krivine, H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1985. 6p. (CONF-8509227—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750757.

From IAEA topical meeting on phase space approach to nuclear dynamics; Trieste, Italy (30 Sep 1985).

We study the finite size effect on the momentum distribution of an ensemble of non-interacting fermions enclosed in a box. Analytical expressions are obtained in two limiting cases. It allows us to analyze the convergence of the momentum disribution toward the standard step function in the infinite medium. Applying our results to the nuclear case, we compare the changes in momentum distribution generated by the finite size of actual nuclei to those due to short range correlations. Both effects are shown to be of same order of magnitude.

10368 (IPNO-TH—85-52) **Periodic solutions of the time dependent Hartree-Fock equations.** Chomaz, P.; Flocard, H.; Vautherin, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1985. 10p. (CONF-850914—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750729.

From Phase space approach to nuclear dynamics meeting; Miramare, Trieste, Italy (30 Sep 1985).

An efficient and simple method, suitable to construct periodic orbits of the time dependent Hartree-Fock equations, is presented. A numerical application to the case of monopole vibrations in helium-4 is discussed.

10369 (IPNO-TH—86-05) **Relativistic description of nuclear matter and finite nuclei in the Hartree-Fock approximation.** Bouyssy, A.; Mathiot, J.F.; Nguyen, V.G.; Marcos, S. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jan 1986. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750731.

The usual Dirac-Hartree description of nuclei is extended to the case where Fock terms are included. The nuclear matter saturation mechanism is studied in the light of non relativistic reductions. Characteristic properties of finite nuclei are also discussed.

10370 (IPNO-TH—86-10) **Critical tests of multifragmentation.** Campi, X. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1986. 1p. (CONF-851299—1-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750730.

From Workshop on 4.... physics; Grenoble, France (16 Dec 1985).

Published in summary form only.

10371 (ITF—85-21-R) **Hydrodynamical response function and monopole excitations in nuclei.** Kolomiets, V.M.; Tsekhmistrenko, I.Yu. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1985. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700209.

The response function for the monopole excitations of nuclei with sharge edge in the time-dependent Thomas-Fermi approximation is obtained. The simultaneous account of the contribution coming from the Fermi surface dynamical deformation to compression modulus and boundary conditions of lowest monopole resonance produces the result close to those of liquid drop model (first sound) and Tassie model. 20 refs.; 1 fig.

10372 (ITP—84-179-E) **Dynamical consideration of the collective mode of nucleons motion in electron scattering by ^{18}O and ^{18}Ne.** Steshenko, A.I.; Maksimenko, V.N.; Tereshin, Yu.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700206.

Electron scattering by ^{18}O and ^{18}Ne mirror nuclei in an elastic as well as in some inelastic channels answering to the nucleus transition from a ground state to one of excited states of a main rotation band was studied. Nuclear form factors of the above-mentioned transitions were calculated on the basis of multiparticle wave functions using the collective basis of a symplectic model Sp(2, R). Theoretical values found agree satisfactorily with experimental data with respect to form factors for these nuclei. 9 refs.; 8 figs.; 3 tabs.

10373 (JINR—R-2-85-481) **Nonlinear σ-model with noncompact symmetry group and the theory of nonideal Bose gas.** Pashaev, O.K.; Sergeenkov, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; Dnepropetrovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1985. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700185.

Submitted to the journal Physica A.

A continuous classical model of the Heisenberg magnet is constructed on the non-compact SU(1, 1)/U(1) manifold which is gauge equivalent to the nonlinear Schroedinger equation (MLS) of the repulsive type. It is shown that the choice of gauge transformation function as the Jost solutions for the NLS linear problem allows one to obtain solutions of the appropriate Σ-model of the magnet. Spin-wave and soliton solutions are presented. Energy, momentum and magnetization integrals are calculated. Spin waves are determined by the Bogoluybov frequency and describe precession on the hyperboloid surface with a fixed Msub(z) value. Soliton solution describes the magnetization vector yield from the precession plane. When condensate density p → O, then the spectrum coincides with the result obtained for SU(2) Heisenberg ferromagnet and with an exact solution for Bethe spin complex. In the case corresponding to unlimited length of vector S, the soliton spectrum coincides with the hole spectrum of antiferromagnet. There magnetizations related to the upper and lower sheets of the hyperboloid compensate for each other. 29 refs.

10374 (JINR—R-4-85-151) **Study on the $O^+ \rightarrow O^-$ transitions in the ^{16}O(p,p′)^{16}O and ^{16}O(p,n)^{16}F reactions.** Gareev, F.A.; Gmitro, M.; Goncharov, S.A.; Ershov, S.N.; Korovin, P.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700210.

The calculations of the cross-sections and analysing power for the transitions $O^+ \rightarrow O^-$ in (p,p′) and (p,n) from ^{16}O for the proton energies 35-135 MeV and the analysis of available data are carried out within the framework of the microscopic antisymmetrized distorted-wave approximation with different effective interactions. Two models for A=16 nuclei: simple particle-hole configuration (2s sub(1/2), 1p sub(1/2)sup(-1)) and correlated wave functions (np, nh) (n=0, 1,2) are considered. The sensitivity of calculations to selected models and effective interactions is demonstrated. It is shown that the exchange tensor part of the reaction amplitude is dominant in T = 0 transitions while for T = 1 the central and tensor contributions are almost equal. It is also demonstrated that the study of the analysing power for these reactions is perspective. 33 refs.; 6 figs.

10375 (JINR—R-5-85-460) **On the probability theory application to some problems arising at registration of particles.** Dvurechenskij, A.; Ososkov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1985. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700186.

Submitted to the 5 International Summer School on Probability Theory and Mathematical Statistics (Varna, PRB, 1985).

The probability theory is applicated to some problems arising at the description of the work of the modified counters with prolonging dead time. Using the method of the semirecurrent events the following problems are studied: the number of particles arrived at the counter during the dead time; the time length distribution between two successive registered particles; the joint distribution of the dead time and the idle period; the solution to the integral equation for the joint distribution in the discrete case; asymptotic properties; the approximate formulae; the idle period and the number of particles arriving during the dead time. 39 refs.; 1 tab.

10376 (KEK—84-20, pp 355-366) **Quark-theoretical model for nuclear shell structure.** Bohr, H. (Danmarks Tekniske Hoejskole, Lyngby). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

A model is presented where the entire nucleus is considered as a M.I.T. bag of a quark gas whose interaction is based on QCD. It leads to a fair and nearly parameter free explanation of the characteristic features of conventional nuclear shell structure. The model thus provides us with the correct radius law and the correct shell sequence. Furthermore the needed direct quark-quark interaction follows from a detailed QCD calculation in which the topological character of the instantons plays a decisive role. Finally a resulting single particle spectrum is presented including the spin-orbit levels as well as the inner excitations of the hypernuclei type.

10377 (KEK—84-20, pp 367-378) **Unified theory of nuclear physics.** Yamaguchi, Yoshio. (Tokyo Univ., Tanashi, Japan. Inst. for Nuclear Study). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

A unified theory of low and medium energy nuclear physics is formulated on the basis of quasi-nucleons interacting with various sorts of Bose fields. An elementary theory of the EMC-effect is also presented.

10378 (KEK—84-20, pp 193-199) **Low energy electromagnetic and weak interactions and the Δ isobar.** Ejiri, H. (Osaka Univ., Toyonaka, Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Some features of the electromagnetic and weak interactions which show more or less the effects of the Δ isobar in nuclei are briefly described. Unique points of the Δ isobar are the strong spin isospin mode and the isospin 3/2 property. And it can contribute directly to the ΔT = ΔT sub(z) = 2 mode such as the double β decay and the double charge exchange of the pion scattering. These require at least two step process for the isospin 1/2 nucleon. Based on the author's recent study, brief comments are given on the spin isospin mode β - γ transitions and the neutrino-less double beta decay.

10379 (KEK—84-20, pp 298-304) **Momentum distribution inside nucleus.** Fujita, T. (Nihon Univ., Tokyo. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

Discussions are made on several reactions which can determine the momentum distribution inside nucleus. The first reaction discussed is the high energy heavy ion collision. This reaction involves many nucleons which interact strongly. Therefore, one must be careful for any possible final state interactions. The expression for the single particle momentum distribution is given. And it can be said that the expression is consistent with the description of the energetic neutrons from muon capture by heavy nucleus. The best way to determine the momentum distribution would be the lepton-nucleus scattering since it does not involve the strong interaction in the initial channel. Another reaction discussed is the backward proton production, which is governed by quite complicated reaction processes. Therefore, the determination of the momentum distribution is only indirect. Nevertheless, it is found that this reaction presents a very interesting and important information on the momentum distribution.

10380 (KEK—84-20, pp 165-175) **Hypernucleus production in relativistic heavy-ion collisions.** Sano, M. (Tokyo Univ., Tanashi, Japan. Inst. for Nuclear Study). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

A coalescence model is used to estimate the hypernucleus production probability in heavy-ion collisions. The production cross section is calculated for the Ne + NaF system at 2.1 GeV/nucleon. We conclude that hypernuclei could be formed with fairly large cross sections.

10381 (KEK—84-20, pp 200-210) **Δ-excitation versus nuclear correlations.** Shimizu, K. (Tokyo Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

With respect to Gamow-Teller type β-decay and transitions, and to pion absorption in nuclei and pionic disintegration of the deuteron, the role of Δ-resonance was discussed. Because of the spin and isospin structures, the Δ-hole excitation is mainly caused by the tensor interaction at low energy region where the relative S state is dominant. It is shown that the Δ-excitation and nuclear correlation are both important for the pion absorption. The latter becomes dominant for lower energy phenomena like the G-T type β-decay. The explanation of the quenching of the G-T type β-decay in terms of the Δ-hole excitation depends on the assumption for the phenomenological interaction. The microscopic calculation shows that the tensor correlation is dominant to explain the quenching of the G-T type transitions.

10382 (KEK—84-20, pp 211-218) **Excitation of delta-hole states.** Hirata, M. (Hiroshima Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

A very qualitative discussion is made on whether the Δ-nucleus Hamiltonian made in connection with the description of the pion nucleus scattering is effective to explain the shift of the peak position of resonance in the A(^{3}He,^{3}H) anything reaction. As the starting point of the discussion, the effective Δ-nucleus Hamiltonian derived by the author is presented. In the second part, explanations are given on the door way state expansion. And finally, the shift of the peak position of resonance is discussed.

10383 (KEK—84-20, pp 219-227) **Pion absorption in the resonance region.** Toki, Hiroshi. (Tokyo Metropolitan Univ., Japan. Dept. of Physics). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

The experimental status of pion absorption in the resonance energy region and the calculated results of various models were discussed. At this moment, it is not conclusive whether the many body mechanisms as the one suggested by Brown et al. (2Δ mechanism) are large in comparison with the standard two body mechanism. In order to get the definite conclusion, the knowledge on the mean free path of nucleons in a nucleus at the intermediate energy (E sub(p) approximately 100 to 200 MeV) is needed. If the mean free path lambda approximately 2 fm, the standard model with further natural extention is the one for pion absorption. If lambda approximately 5 to 6 fm, then the 2Δ mechanism is the strong candidate for pion absorption in the resonance region.

10384 (KEK—84-20, pp 176-186) **Decay of hypernuclei.** Bando, H. (Fukui Univ., Japan). Feb 1985. NTIS (US Sales Only), PC A18/MF A01. File Number DE87780048. (CONF-8411279—).

From KEK international workshop on nuclear physics in GeV region; Oho, Ibaraki, Japan (13 Nov 1984).

The pionic and non-mesonic decays of hypernuclei are discussed. In the first part, various decay processes which could be useful to obtain information of hypernuclear structure are discussed. The experimental data concerning the pionic and non-mesonic decays are discussed in the second part. As the experimental data, there are only few lifetime data and some crude data on the non-mesonic to π decay ratio. In the third and the fourth parts, some theoretical analyses are made on the pionic and the nonmesonic decays. DDHF calculation was performed for Λ and N systems by using Skyrme type ΛN and NN effective interactions. A suppression factor of the order of 10^{-3} for A nearly equal 100 was obtained.

10385 **(KFKI—1986-19/A) Effect of correlations on entropy and hadro-chemical compositions in heavy ion reactions.** Barz, H-W.; Biro, T.S.; Lukacs, B.; Zimanyi, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Giessen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). May 1986. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700251.

It is shown that spatial correlations between the constituent particles of a gas lead to roughly excluded volume type corrections in the equation of state. These corrections do appreciably change the hadrochemical composition of fireballs formed in heavy ion reactions. 29 refs.; 3 figs.

10386 **(KFKI—1986-24/A) Should the coupling constants be mass dependent in the relativistic mean field models.** Levai, P.; Lukacs, B.; Waldhauser, B.; Zimanyi, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Frankfurt Univ. (Germany, F.R.)). May 1986. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700250.

Mass dependent coupling constants are proposed for baryonic resonances in the relativistic mean field model, according to the mass splitting of the SU-6 multiplet. With this choice the negative effective masses are avoided and the system remains nucleon dominated with moderate antidelta abundance. 15 refs.; 4 figs.

10387 **(KFTI—84-26) On a parametrization of triton wave function.** Kotlyar, V.V.; Shebeko, A.V. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR); AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1984. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700207.

The solutions of Faddeev equations in the momentum representation for the 3N-system bound state are obtained. A case of separable NN-interaction in $^1S_0$- and $^3S_1$-states is considered. Charge dependence of nuclear forces is taken into account. The pole type approximation for the ^{3}H nucleus wave function calculated with Mongan potential is given. 43 refs.; 4 figs.; 4 tabs.

10388 **(LA-UR—86-3789) Matter oscillations and solar neutrinos: A review of the MSW [Mikheyev-Smirnov-Wolfenstein] effect.** Rosen, S.P.; Gelb, J.M. (Los Alamos National Lab., NM (USA)). 16 Jul 1986. Contract W-7405-ENG-36. 13p. (CONF-860701—64). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002916.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

We review the theory of the Mikheyev-Smirnov-Wolfenstein effect, in which matter oscillations can greatly enhance "in vacuo" neutrino oscillations, and we examine its consequences for the solar neutrino problem. Using a two-flavor model, we discuss the solutions in the Δm^2-$\sin^2 2\Theta$ parameter space for the ^{37}Cl experiment, and describe their predictions for the ^{71}Ga experiment and for the spectrum of electron-neutrinos arriving at earth. We also comment on the three-flavor case.

10389 **(LA-UR—86-3980) A review of matter oscillations and solar neutrinos.** Rosen, S.P. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 6p. (CONF-8606215—19). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002899.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

We review the theory of the Mikheyev-Smirnov-Wolfenstein effect, and examine its consequences for the solar neutrino problem. Using a two-flavor model, we discuss the solutions in the Δ^2-$\sin^2 2\Theta$ parameter space for the ^{37}Cl experiment, and describe their predictions for the ^{71}Ga experiment and for the spectrum of electron-neutrinos arriving at earth. 18 refs.

10390 **(LA-UR—86-3998) Medium energy hadron scattering from nuclei.** Ginocchio, J.N.; Wenes, G. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 40p. (CONF-8609209—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE87002894.

From Workshop on the relations between structure and reactions in nuclear physics; Philadelphia, PA, USA (15 Sep 1986).

The Glauber approximation for medium energy scattering of hadronic projectiles from nuclei is combined with the interacting boson model of nuclei to produce a transition matrix for elastic and inelastic scattering in algebraic form which includes coupling to all the intermediate states. We present closed form analytic expresions for the transition matrix elements for the three dynamical symmetries of the interacting boson model; that is for, a spherical quadrupole vibrator, a γ unstable rotor, and both prolate and oblate axially symmetric rotors. We give examples of application of this formalism to proton scattering from ^{154}Sm and ^{154}Gd. 27 refs., 5 figs., 1 tab.

10391 **(LA-UR—86-4012) Spin quenching in the SO_8 and SP_6 fermion models of collective motion.** Ginocchio, J.N. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8610110—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002895.

From 15. international colloquium on group theoretical methods in physics; Philadelphia, PA, USA (20 Oct 1986).

The SO_8 and SP_6 models assume that the low-lying collective states of heavy nuclei are dominated by collective pairs of fermions coupled to angular momentum $j = 0^+, 2^+$. These models are generalizations of the pairing model (SP_2) to include the quadrupole degree of freedom. The expectation value of the spin operator in the SO_8 and SP_6 models is studied. 2 refs., 1 tab. (DWL)

10392 **(RRK—85-24) On the quantization of supersymmetric particle.** Terao, H.; Uehara, S. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics; Kyoto Univ. (Japan). Dept. of Physics). Aug 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700245.

The modified action of Siegel for a point superparticle is quantized by using the BRS transformation. The second quantization is also discussed.

10393 **(UCRL—15847-Vol.1) Calculated fission properties of the heaviest elements.** Moeller, P.; Nix, J.R.; Swiatecki, W.J. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA); Lawrence Berkeley Lab., CA (USA)). Sep 1986. Contract W-7405-ENG-48. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87002931.

A quantitative calculation is presented that shows where high-kinetic-energy symmetric fission occurs and why it is associated with a sudden and large decrease in fission half-lives. The study is based on calculations of potential-energy surfaces in the macroscopic-microscopic model and a semi-empirical model for the nuclear inertia. For the macroscopic part a Yukawa-plus-exponential model is used and for the microscopic part a folded-Yukawa single-particle potential is used. The three-quadratic-surface parameterization generates shapes for which the potential-energy surfaces are calculated. The use of this parameterization and the use of the finite-range macroscopic model allows for the study of two touching spheres and similar shapes. The results of the calculations in terms of potential-energy surfaces and fission half-lives are presented for heavy even nuclei. The surfaces are displayed in the form of contour diagrams as functions of two moments of the shape. 53 refs., 15 figs., 1 tab.

10394 **(UEF—01-85) Quasioptical cascade model of the ^{4}He+p interaction at intermediate energies.** Bano, M.; Kravcikova, M.; Rusnakova, E.; Sandor, L.; Martinska, G.; Patocka, J.; Urban, J.; Hlavacova, J. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky; Univerzita P.J. Safarika, Kosice (Czechoslovakia); Vysoka Skola Technicka, Kosice (Czechoslovakia)). Feb 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700252.

To be published in Acta Physica Slovaca.

The preprint describes the quasioptical cascade model of collisions between the lightest nuclei and hadrons at momenta of 1.5 to 6 GeV/c per nucleon with special attention to the ^{4}He+p interaction. The described model is suitable for the determination of the total cross section of the whole interaction, its elastic scattering channel, and for determining the detailed characteristics of pionless fragmentation channels. The model incorporates the production of the Δ(1232) isobar and its absorption in a collision with a proton as well as Fraunhofer's diffractive scattering on a semitransparent nucleus.

10395 **Resolved resonance parameters for /sup 238/U from 1 to 10 keV.** Olsen, D.K. (Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN 37831). *Nuclear Science and Engineering;* 94: No. 1, 102-106(Sep 1986). Contract AC05-84OR21400.

The s-wave strength function from 676 resonances between 0.9 and 10.0 keV is reported from a consistent least-squares simultaneous-sample shape analysis of the Oak Ridge Electron Linear Accelerator 150-m four-sample /sup 238/U transmission data. The neutron widths from 0.9 to 6.0 keV from this improved analysis are meant to supersede previously published values. These resonances give an s-wave strength function of about 0.94 x 10/sup -4/ from 0 to 10 keV.

10396 **Measurement and evaluation of selected 14-MeV neutron cross sections for fusion.** Meadows, J.W.; Smith, D.L.; Cox, S.A. (Argonne National Lab., Argonne, IL). pp 123-127 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Experimental neutron-activation cross-section data in the vicinity of 14 MeV are evaluated for several reactions of fusion-related interest using a least-squares method. New experimental measurements are performed at 14.7 MeV for all of these considered reactions and for some commonly-used standard reactions as well. Comparison is made between measured and evaluated results.

10397 **Effect of fission dynamics on the spectra and multiplicities of prompt fission neutrons.** Nix, J.R.; Madland, D.G.; Sierk, A.J. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM 87545). pp 263-276 of Nuclear data for basic and applied science. Volume 1. Young, P.G.; Brown, R.E.; Auchampaugh, G.F.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

With the goal of examining their effect on the spectra and multiplicities of the prompt neutrons emitted in fission, the authors discuss recent advances in a unified macroscopic-microscopic description of a large-amplitude collective nuclear dynamics. The conversion of collective energy into a single-particle excitation energy is calculated for a new surface-plus-window dissipation mechanism. By solving equations of motion for initial conditions appropriate to fission, the authors obtain the average fission-fragment translational kinetic energy and excitation energy. The spectra and multiplicities of the emitted neutrons, which depend critically upon the average excitation energy, are then calculated on the basis of standard nuclear evaporation theory, taking into account the average motion of the fission fragments, the distribution of fission-fragment residual nuclear temperature, the energy dependence of the cross section for the inverse process of compound-nucleus formation, and the possibility of multiple-chance fission. Some illustrative comparisons of the authors' calculations with experimental data are shown.

10398 **Level densities for basic and applied nuclear physics.** Grimes, S.M. (Ohio Univ., Athens, OH 45701). pp 995-1006 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Nuclear level densities are a key ingredient in compound nuclear reaction calculations. They are, therefore, of importance to fields as diverse as fission and fusion reactor design and astrophysics. A review of present methods for calculating level densities is presented, which includes global approximation methods and rotational enhancement factors. New information about level density parameter systematics should be forthcoming from Hartree-Fock and shell model methods. The strengths and limitations of these techniques for calculating level densities are summarized. It is concluded that more work on both empirical and microscopic models is needed to improve their ability to calculate level densities for nuclei off the stability lines.

10399 **New test of the nuclear statistical model.** Mitchell, G.E. (North Carolina State Univ., Raleigh, NC). pp 1021-1032 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

High resolution proton resonance measurements provide a new test of the nuclear statistical model. For a sequence of levels with the same spin and parity the width correlation rho/sub W/ and the amplitude correlation rho/sub A/ are determined separately for the inelastic decay channels. The observed correlations average about 0.5 and are ascribed to direction reactions between the inelastic channels. For a multivariate Gausian distribution rho/sup 2//sub A//rho/sub W/=1. The present data provide the first opportunity to test this prediction directly.

10400 **Pairing correction of particle-hole state densities for two kinds of fermions.** Fu, C.Y. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 1115-1119 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Pairing corrections in particle-hole (exciton) state-density formulas used in precompound nuclear rection theories are, strictly speaking, dependent on the nuclear excitation energy U and the exciton number n. A general formula for (U,n)-dependent pairing corrections have been derived in an earlier paper for exciton state-density formulas for one kind of Fermion. In the present paper, a similar derivation is made for two kinds of Fermions. It is shown that the constant-pairing-energy correction used in standard level-density formulas, such as U/sub o/ in Gilbert and Cameron, is a limiting case of the present general (U,n)-dependent results.

10401 **Reaction cross-section calculations using new experimental and theoretical level structure data for deformed nuclei.** Hoff, R.W.; Gardner, D.G.; Gardner, M.A. (Lawrence Livermore National Lab., Livermore, CA 94550). pp 1125-1129 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract W-7405-ENG-48.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

A technique for modelling level structures of odd-odd nuclei has been used to construct sets of discrete states with energies in the range 0 - 1.5 MeV for several nuclei in the rare-earth and actinide regions. The accuracy of the modeling technique was determined by comparison with experimental data. Examination was made of what effect the use of these new, more complete sets of discrete states has on the calculation of level densities, total reaction cross sections, and isomer ratios.

10402 **Proton:Neutron yield ratios in the exciton model.** Kalbach, C. (Physics Dept., Duke Univ., Durham, NC 27706). pp 1159-1162 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The factors in the two-component exciton model which can influence the relative yields of neutrons and protons; various options for treating them; and their importance in different mass/energy domains were discussed. The preferred descriptions are being evaluated through comparisons with experimental energy spectra.

10403 **Use of shell model calculations in r-matrix studies of neutron-induced reactions.** Knox, H.D. (Ohio Univ., Athens, OH 45701). pp 1006-1018 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

R-matrix analyses of neutron-induced reactions for many of the lightest p-shell nuclei are difficult due to a lack of distinct resonance structure in the reaction cross sections. Initial values for the required R-matrix parameters, Eλ /sub and γλc for states in the compound system, can be obtained from shell model calculations. In the present work, the results of recent shell model calculations for the lithium isotopes have been used in R-matrix analyses of /sup 6/Li+n and /sup 7/Li+n reactions for En/ < 8 MeV. Consequences of the shell model predictions for the level structure of /sup 7/Li and /sup 8/Li on the /sup 6/Li+n and /sup 7/Li+n reaction mechanisms and cross sections are discussed.

10404 **R-matrix analysis of the /sup 7/Li system with peripheral channel overlap exchange effects.** Hale, G.M. (Los Alamos National Lab., Los Alamos, NM). pp 1103-1107 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The parameters of an R-matrix analysis that includes data for all reactions open in the /sup 7/Li system at E/sub x/ ≦ 10 MeV suggest that deuteron exchange contributes to the low-energy /sup 6/Li(n,t) reaction. A method for including this mechanism directly in the theory is discussed and preliminary results are given.

10405 **/sup 58/Ni + n transmission, capture and differential elastic scattering data analysis in the resonance region.** Perey, C.M.; Perey, F.G.; Harvey, J.A.; Hill, N.W.; Macklin, R.L. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 1639-1642 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

High resolution neutron transmission, capture and differential elastic scattering measurements have been made for /sup 58/Ni-enriched targets at Oak Ridge Electron Linear Accelerator (ORELA) from the eV to the MeV region. The three sets of data were analyzed simultaneously from 10 to 450 keV, and the transmission analysis was extended to 650 keV. For the 52 s-wave resonances observed between 10 and 650 keV, the average level spacing, D/sub O/, and the strength function, S/sub O/, are 12.2 +. 1.0 keV and (3.1 +. 0.6) X 10/sup -4/, respectively.

10406 **R-matrix analysis of the /sup 239/Pu neutron cross sections.** deSaussure, G.; Perez, R.B.; Macklin, R.L. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 1635-1638 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract FG05-85ER40188.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

/sup 239/Pu neutron cross-section data in the resolved resonance region were analyzed with the R-Matrix Bayesian Program SAMMY. Below 30 Ev the cross sections computed with the multilevel parameters are consistent with recent fission and transmission measurements as well as with older capture and alpha measurements. Above 30 eV no suitable transmission data were available and only fission cross-section measurements were analyzed. However, since the analysis conserves the complete covariance matrix, the analysis can be updated by the Bayes method as transmission measurements become available. To date, the analysis of the fission measurements has been completed up to 300 eV.

10407 **Analysis of neutron data in the resonance region via the computer code SAMMY.** Larson, N.M. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 1533-1536 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC05-84OR21400.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Procedures for analysis of resonance neutron cross-section data have been implemented in a state-of-the-art computer code SAMMY, developed at the Oak Ridge Electron Linear Accelerator (ORELA) at Oak Ridge National Laboratory. A unique feature of SAMMY is the use of Bayes' equations to determine "best" values of parameters, which permits sequential analysis of data sets (or subsets) while giving the same results as would be given by a simultaneous analysis. Another important feature is the inclusion of data-reduction parameters in the fitting procedure. Other features of SAMMY are also described.

10408 **Difficulties with inferring neutron cross sections from charged-particle reactions.** Gardner, D.G.; Gardner, M.A. (Lawrence Livermore National Lab., Livermore, CA 94550). pp 1529-1532 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract W-7405-ENG-48.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

The authors have investigated problems associated with inferring cross sections for neutron reactions on unstable nuclei in the mass-90 region from charged-particle reactions on nearby stable targets. They conclude that effects due to precompound evaporation, isospin, and multiple reaction paths severely limit the circumstances under which charged-particle studies may be directly and easily converted to neutron cross sections of useful accuracy.

10409 **Calculational tools for the evaluation of nuclear cross-section and spectra data.** Gardner, M.A. (Lawrence Livermore National Lab., Livermore, CA). pp 1481-1492 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract W-7405-ENG-48.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Continued improvements in the calculational methods for obtaining nuclear reaction cross sections and spectra provide indispensable tools for nuclear data evaluations.

10410 **Prompt neutron multiplicities for the transplutonium nuclides.** Holden, N.E.; Zucker, M.S. (Brookhaven National Lab., Upton, NY). pp 1631-1634 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—). Contract AC02-76CH00016.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

In response to a need of the safeguards community, the authors have begun an evaluation effort to upgrade the values of the prompt neutron emission multiplicity distribution from fission, Pν/ sub , and its average value $<\nu>$. The reported Pν for various transplutonium nuclides have been renormalized via an independent evaluation of $<\nu>$. /Recommended values and uncertainties are given for the newly evaluated $<\nu>$ and Pν.

10411 **Recent developments in the understanding of pion-nucleus scattering.** Johnson, M.B. (Los Alamos National Lab., Los Alamos, NM). pp 361-414 of Proceedings of the international summer school on nucleon-nucleon interaction and nuclear many-body problems. Wu, S.S.; Kuo, T.T. Singapore, Singapore; World Scientific Pub. Co. Pte. Ltd. (1984). (CONF-8307102—).

From International symposium on nucleon-nucleon interaction and nuclear many-body problems; Beijing, China (1 Jul 1983).

A development of the theory of pion-nucleus scattering is given in a field theoretical framework. The theory is designed to describe pion elastic scattering and single- and double-charge exchange to isobaric analog states. An analysis of recent data at low and resonance energies is made. Strong modifications to the simple picture of the scattering as a succession of free pion-nucleon interactions is required in order to understand the data. The extent to which the experiment is understood in terms of microscopic theory is indicated.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 9026, 9127, 9145, 9146, 9349, 9579, 9815, 9816, 9817, 9818, 9819, 9820, 9821, 9822, 9861, 10405

10412 (CRN-CPR—85-16) **Fast neutron analysis code SAD1.** Jung, M.; Ott, C. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1985. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750753.

FORTRAN, IBM-3081.

A listing and an example of outputs of the M.C. code SAD1 are given here. This code has been used many times to predict responses of fast neutrons in hydrogenic materials (in our case emulsions or plastics) towards the elastic n, p scattering. It can be easily extended to other kinds of such materials and to any kind of incident fast neutron spectrum.

10413 (INDC(NDS)—179/G, pp 31-43) **Displacement model for the calculation of radiation damage.** Jinnan Yu. (Academia Sinica, Beijing, China. Inst. of Atomic Energy). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

This paper describes the concept of a multifold displacement threshold energy, which correlates displacement production under electron, proton, and neutron irradiation. An effective threshold energy is derived from a concept of a second-fold threshold energy surface. When details of the time-dependent energy loss of recoils that result from a primary event are considered, the slowing down number of recoils and second-fold threshold energy surface concept adequately describes the correspondence between the cascade process and crystallographic effects. 10 refs, 7 figs.

10414 (INIS-SU—354, pp 28-31) **Appearance of anisotropy in angular distribution of ultracold neutrons with account of ultracold neutron absorption by trap walls.** Antonov, A.V.; Goryachev, B.I.; Isakov, A.I.; Lin'kova, N.V. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike.; (No. 11).

In Plasma physics. Collection.

By the Monte Carlo method the analysis of angular and spatial distributions of ultracold neutrons (UCN) in a copper cylindrical trap under different conditions of UCN absorption intrap walls is performed. 3 refs.; 2 figs.

10415 (INIS-SU—365, pp 48-55) **New method for the measurement of the polarization characteristics of ferromagnetic films on ultracold neutrons.** Taran, Yu.V. 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780050. (N—12-85).

In JINR rapid commutations. Collection.

A new method has been developed for measuring the polarization characteristics of ferromagnetic films on ultracold neutrons (UCN) by single-, double- and triple-transmission of UCN beam through one and the same film. To realize the method an installation has been proposed consisting of the two UCN storage traps connected with a mirror neutron guide. An investigated film is placed in the slit in the middle of the neutron guide. On both sides of the film a spin-flipper is installed bottle is equiped with three neutron values which permit filling in the bottle with UCN and allow oneto let UCN out to the neutron guide or detector. The neutrons once let out from one bottle into the neutron guide are caught by the other. The film can be moved out of the neutron guide or rotated. By manipulating with spin-flippers and the film one may take the integral polarization parameters of the film: transmission, polarizing and analysing efficiencies, so-called S-factor, which is the fourth independent linear combination of the elements of the square 2 x 2 transmission matrix of the film. The measurement parameters help to restore the film transmission matrix. Then a comparison is drawn with the theoretical models of UCN depolarization on transmission through a ferromagnetic film.

10416 (IPNO-T—85-07) **Measurement of stopping powers of gases for heavy ions of 3 to 13 MeV by nucleon.** Orliange, I. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Sep 1985. 152p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE87750711.

The stopping powers of gases have been measured for incident ^{10}Ne, ^{18}Ar, ^{29}Cu, ^{36}Kr and ^{47}Ag ions of 3 to 13 MeV/u. These measurements have confirmed the existence of a gas-solid difference for the stopping powers (the stopping power of solids being larger than that of gases). Such a difference was theoretically postulated by Bohr and Lindhard in 1954, and experimentally observed for the first time by Geissel in 1982. This effect can be qualitatively interpreted by a difference in the ion's effective charge in stopping power. However, the determination of charge state distribution for Ar and Fe ions in two particular cases (Ar + Nsub(2s)or Nsub(2g) and (Fe + Csub(s) or Csub(g) from a theoric model and experimental cross sections for atomic collisions don't quantitatively account for observed differences.

10417 (Juel-Spez—316) **Report on the meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projekttraegerschaft Nukleare Festkoerperforschung und Nuklearchemie). Jun 1985. 284p. (In German). (CONF-8410450—). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303.

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The present volume consists of 55 lectures. The subjects are: 1) Elastic neutron diffraction, 2) Lattice dynamics, 3) Diffusion, 4) Polymers, 5) Biology, 6) Methods and tools, 7) Magnetism. For distinct papers see hints under relevant topics. (BHO).

10418 (Juel-Spez—316, pp 56-58) **Rotation tunneling of coupled groups.** Heidemann, A. Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

10419 (Juel-Spez—316, pp 226) **Interferometric investigation of the propagation of thermal neutrons in a moved medium.** Bonse, U.; Rumpf, A. (Dortmund Univ., Germany, F.R. Inst. fuer Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

10420 (KURRI-TR—249, pp 34-40) **Experiments using LHTL in JAERI.** Takamura, Saburo; Maeta, Hiroshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

The liquid helium temperature loop (LHTL) in the Japan Atomic Energy Research Institute finished the irradiation experiment in March, 1983, accompanying the reconstruction of JRR-3 reactor, and at present, the removing work is in progress. This facility was built so as to be able to irradiate fast neutrons at 5 K, and in the state of having frozen the defects formed by irradiation, electric resistance, internal friction, X-ray scattering, length, mechanical strength and so on were able to be measured, and the state of recovery of irradiation defects accompanying temperature rise was able to be investigated. Recently, the irradiation damage of superconducting magnet materials used for nuclear fusion reactors has become a problem, and the importance of the irradiation experiment at extremely low temperature has increased. The LHTL engaged also in this problem. The transfer of irradiated specimens to the cryostat for measurement, the measurement of electric resistance, X-ray and the change of length, and compression test are reported. As for the properties of irradiation defects in metals, the examples of experiment carried out by the authors are briefly described. The effect of the irradiation at very low temperature on superconducting magnet materials is reported.

10421 **(KURRI-TR—249) Report of the meeting at KURRI on 'design of the facility for high flux and low temperature irradiations'.** Shibata, Toshikazu; Yoshida, Hiroyuki; Nakagawa, Masuo (eds.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1984. 145p. (In Japanese). (CONF-8311298—). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042.

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

Separate abstracts were prepared for each of the individual papers. (DWL)

10422 **Reanalysis of tritium production in a sphere of /sup 6/LiD irradiated by 14-MeV neutrons.** Fawcett, L.R. Jr. (Los Alamos National Lab., Los Alamos, NM). pp 1581-1584 of Nuclear data for basic and applied science. Volume 2. Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). (CONF-850507—).

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

Tritium production in a sphere of /sup 6/LiD irradiated by a central source of 14-MeV neutrons reported previously has been reanalyzed. The /sup 6/LiD sphere consisted of 10 solid hemispherical shells nested with ampules of /sup 6/LiH and /sup 7/LiH located at 5.0, 7.7, 12.6, 20.0 and 30.0 cm from the center. The Los Alamos Monte Carlo Neutron Photon Transport Code was used to calculate neutron transport through the /sup 6/Lid and tritium production in the ampules. The model was three dimensional and employed ENDF/B-V cross sections.

6550 Medical Physics

REFER ALSO TO CITATION(S) 8941, 9921, 9922, 9923

10423 **(CONF-861123—1) Dosimetric data for the fetus derived from an anatomical model of its mother at the end of the first trimester.** Davis, J.L.; Stabin, M.G.; Cristy, M.; Ryman, J.C. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Chattanooga (USA). Dept. of Physics; Oak Ridge Associated Universities, Inc., TN (USA)). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02. File Number DE87003009.

From CEC/CEA international workshop on age-related factors in radionuclide metabolism and dosimetry; Angers, France (26 Nov 1986).

We discuss a study of the radiation transport of monoenergetic photons within a mathematical phantom of the pregnant female at the end of the first trimester. This phantom was developed from the adult female member of the ORNL phantom series with modifications reflecting anatomical changes at this stage of pregnancy. This geometry was incorporated into the ALGAMP Monte Carlo radiation transport code used at ORNL with the phantom series. For internal sources of radiation the emission of 60,000 monoenergetic photons at each of 12 energies within 30 organs of the body was simulated. Energy deposition within 158 regions of the body, including uterine wall, uterine contents, and 12 subregions within the contents, was tabulated. The results are presented in terms of the specific absorbed fraction, i.e., the fraction of the photon energy emitted within a source organ that is absorbed per unit mass of the target region. The specific absorbed fraction data are commonly used to evaluate the dose associated with internal emitters, e.g., from administered radiopharmaceuticals. Additional calculations have been performed for a uniform, isotropic field of photons incident on the surface of the phantom; these data provide information on the shielding of the fetus by the mother and are of interest in evaluation of doses from external radiation fields. In this study we have provided dosimetric information useful in making quantitative risk estimates for the developing fetus. Our investigations demonstrate that even at this early stage in pregnancy the effective dose equivalent to the mother cannot be used as an index of the dose equivalent to the fetus. Further efforts will be directed to consideration of later stages in fetal development and consideration of irradiation by external neutron fields.

10424 **(CONF-861123—2) A comprehensive approach to age-dependent dosimetric modeling.** Leggett, R.W.; Cristy, M.; Eckerman, K.F. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003003.

From CEC/CEA international workshop on age-related factors in radionuclide metabolism and dosimetry; Angers, France (26 Nov 1986).

In the absence of age-specific biokinetic models, current retention models of the International Commission on Radiological Protection (ICRP) frequently are used as a point of departure for evaluation of exposures to the general population. These models were designed and intended for estimation of long-term integrated doses to the adult worker. Their format and empirical basis preclude incorporation of much valuable physiological information and physiologically reasonable assumptions that could be used in characterizing the age-specific behavior of radioelements in humans. In this paper we discuss a comprehensive approach to age-dependent dosimetric modeling in which consideration is given not only to changes with age in masses and relative geometries of body organs and tissues but also to best available physiological and radiobiological information relating to the age-specific biobehavior of radionuclides. This approach is useful in obtaining more accurate estimates of long-term dose commitments as a function of age at intake, but it may be particularly valuable in establishing more accurate estimates of dose rate as a function of age. Age-specific dose rates are needed for a proper analysis of the potential effects on estimates or risk of elevated dose rates per unit intake in certain stages of life, elevated response per unit dose received during some stages of life, and age-specific non-radiogenic competing risks.

10425 **(DOE/ID—12104) The Department of Energy Laboratory Accreditation Program in personnel dosimetry: Results of the pilot performance test.** Carlson, R.D.; Gesell, T.F. (USDOE Idaho Operations Office, Idaho Falls. Radiological and Environmental Sciences Lab.). Oct 1986. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87002842.

A complete pilot test of the Department of Energy Laboratory Accreditation Program (DOELAP) has been conducted. Six Department of Energy (DOE) and DOE contractor personnel dosimetry programs were involved in the pilot test. Nine dosimeter types were tested, including three separate neutron dosimeters. Both film dosimeter and thermoluminescent dosimeter (TLD) types were represented for low-energy photon, high-energy photon, and beta categories. TLD-albedo and track-etch dosimeter types were represented for neutron categories. As a group, the participants met the test criteria in only 38% of the categories. The test data showed, however, that Participant F had a serious calibration problem that distorted the overall results. The other five participants met the test criteria in 48% of the categories. The most difficult categories appeared to be the low-energy photon accident category, the low-energy photon + beta mixture categories, and the neutron categories. Most participants had difficulty in any category that required a low-energy photon irradiation.

10426 **(EGG-M—17986) Beta particle measurement fundamentals.** Alvarez, J.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 28p. (CONF-8606139—9). NTIS, PC A03/MF A01; GPO Dep. File Number DE87001441.

From Health Physics Society meeting; Pittsburgh, PA, USA (29 Jun 1986).

The necessary concepts for understanding beta particle behavior are stopping power, range, and scattering. Dose as a consequence of beta particle interaction with tissue can be derived and explained by these concepts. Any calculations of dose, however, assume or require detailed knowledge of the beta spectrum at the tissue depth of calculation. A rudimentary knowledge of the incident spectrum can be of use in estimating dose, interpreting dose measuring devices and designing protection. The stopping power and range based on the csda will give a conservative estimate in cases of protection design, as scattering will reduce the range. Estimates of dose may be low because scattering effects were neglected.

10427 (INIS-mf—10512, pp 85) **Metrological problems in the Fermi age measurement of an Am-Be neutron source in water.** Bensch, F.; Prochazka, W.; Zawisky, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10428 (INIS-XN—31) **Code of Nursing Practice for Staff Exposed to Ionizing Radiation (1984).** (International Atomic Energy Agency, Vienna (Austria)). 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700299.

This Code, published by the National Health and Medical Research Council and intended for nurses and auxiliary staff provides general guidance on radiation protection. The Code is supplementary to radiation control legislation relating to the use of ionizing radiation in medical practice. The principles established by the recommendations of the International Commission on Radiological Protection (ICRP) have been taken into account.

10429 (INIS-XN—32) **Code of Practice for Protection Against Ionizing Radiation Emitted from X-ray Analysis Equipment (1984).** (International Atomic Energy Agency, Vienna (Austria)). 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700300.

Appropriate working rules, safety features and monitoring requirements for general X-ray analysis units or equipment are laid down in this Code which is intended for users of such equipment. The Code advises that establishments draw up their own working procedures based on appropriate legislation and on the recommendations contained in this Code. The Code also describes the requirements for X-ray analysis equipment necessary to ensure safety.

10430 (PNL-SA—13686) **The sources of uncertainties associated with internal dose calculations.** Traub, R.J.; Robinson, A.V. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 17p. (CONF-860146—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002715.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

These are uncertainties associated with internal dose calculations. The total uncertainty of internal dose calculations is a combination of the errors associated with each variable. These uncertainties are described in this paper: (1) undetected annual dose commitment; (2) bioassay accuracy; (3) errors in excretion/retention functions; (4) distribution of radioactive material within the body; (5) error due to unknown time of intake; (6) organ mass variation; (7) fraction of the emitted radiation deposited in the target organ; and (8) nonparallel metabolism of parent-progeny radionuclides. (ACR)

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 9412, 10150, 10168

10431 (CEA-CONF—8471) **Moessbauer evidence for magnetic ordering in YbP.** Bonville, P.; Hodges, J.A.; Hulliger, F.; Imbert, P.; Ott, H.R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Jul 1986. 10p. (CONF-860746—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750772.

From Anomalous rare earths and actinides; Grenoble, France (7 Jul 1986).

^{170}Yb Moessbauer experiments confirm that the heavy-electron type compound YbP is magnetically ordered below 0.41 K. The saturated spontaneous moment of Yb is much smaller than that of the Yb^{3+} GAMMA$_8$ doublet, which is the high-temperature ground-state level.

10432 (CONF-861114—29) **Dynamical image charge effects on convoy electron emission from solid surfaces.** Burgdoerfer, J. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics). 1986. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002628.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

We analyze surface effects on the spectrum of convoy electrons emitted from solids in close association with fast highly charged ions. Three competing mechanisms have been identified: Deceleration by the surface barrier, acceleration by the repulsive dynamical image force, and energy loss due to surface plasmon generation. The resulting energy shift is significantly reduced compared to the value for the barrier height for a jellium surface. We also give estimates for the probability for non-adiabatic transitions between bound states due to the sudden perturbation by the potential step upon exit.

10433 (DOE/ER/45222—3) **High-resolution He beam scattering as a tool for the investigation of the structural and dynamical properties of surface soliton dislocations.** El-Batanouny, M.; Martini, K.M. (Boston Univ., MA (USA). Dept. of Physics). 1986. Contract FG02-85ER45222. 8p. (CONF-8605199—3). NTIS, PC A02. File Number DE87000986.

From 6. CNLS annual conference on nonlinearities in condensed matter; Los Alamos, NM, USA (4 May 1986).

We discuss the applicability of high-resolution-He-beam/surface scattering to the investigation of the structural and dynamic properties of soliton-like surface misfit dislocations and associated phase transitions. We present evidence, based on recent He diffraction measurements, for the existence of double-sine-Gordon soliton-like dislocations on the reconstructed Au(111) surface. 18 refs., 3 figs., 1 tab.

10434 (DOE/NBM—7003141) **The IPNS [Intense Pulsed Neutron Source] Rietveld analysis software package for time-of-flight powder diffraction data: Recent developments.** Rotella, F.J.; Richardson, J.W. Jr. (Argonne National Lab., IL (USA); Chicago Univ., IL (USA). Dept. of Geophysical Sciences). [1986]. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003141.

The system of computer programs used at IPNS for the analysis of time-of-flight neutron powder diffraction data via the Rietveld method has been modified recently to analyze data from multiple phase samples, exhibiting diffraction maxima broadened from anisotropic sample strain, that can be modeled by atomic anharmonic thermal vibrations, and showing scattering from noncrystalline sample components, analyzed using Fourier-filtering techniques.

10435 (IS-T—1275) **First-principles study of phonon anomalies and the bcc-hcp martensitic phase transition.** Chen, Y. (Ames Lab., IA (USA)). Nov 1986. Contract W-7405-ENG-82. 112p. NTIS, PC A06/MF A01; GPO Dep. File Number DE87003050.

First-principles total energy calculations have been performed for transition metal Zr in the ω, bcc, hcp, fcc structures and for Ba in the bcc, fcc structures. From our calculations we obtained equilibrium lattice constants, cohesive energies, bulk moduli and energy difference between the bcc and the hcp phases which are in good agreement with experiment. The total energy of ω phase was found to be very close to that of hcp phase in Zr. Recent neutron scattering experiments on a single crystal of bcc Ba have revealed that the longitudinal branch along the [100] direction is lower than the transverse branch. This anomalous behavior has been studied with use of the frozen-phonon method and is shown to arise from d-electron interactions. For the pressure induced bcc-hcp transition in Ba, the volume dependence of the complete energy surface from the bcc to the hcp structure has been determined as a function of the atomic displacements corresponding to the T_1 N-point phonon mode and a long wavelength shear. Results from frozen phonon calculations for Zr indicate an instability toward the hcp phase at t = 0 K in the bcc-hcp transition and determine the third and fourth order anharmonic coupling strengths which were used to evaluate the temperature dependence of selected frequencies. 135 refs., 29 figs., 13 tabs.

10436 **(LA-UR—86-3819) Lessons from the past and prospects for the future?.** Baym, G. (Los Alamos National Lab., NM (USA); Illinois Univ., Urbana (USA). Dept. of Physics). 4 May 1986. Contract W-7405-ENG-36. 5p. (CONF-8605199—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002912.

From 6. CNLS annual conference on nonlinearities in condensed matter; Los Alamos, NM, USA (4 May 1986).

The author presents his impressions of the conference - that is - major lessons as presented in the talks on nonlinearities and their role in condensed matter physics. (WRF)

10437 **(LA-UR—86-3820) Temperature dependence of the soft mode for structural phase transitions in highly anisotropic systems.** Bishop, A.R.; Kerr, W.C. (Los Alamos National Lab., NM (USA); Wake Forest Univ., Winston-Salem, NC (USA). Dept. of Physics). 1986. Contract W-7405-ENG-36. 6p. (CONF-8605199—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002911.

From 6. CNLS annual conference on nonlinearities in condensed matter; Los Alamos, NM, USA (4 May 1986).

It is shown that describing the dynamics of structural phase transition in highly anisotropic systems requires the introduction of another characteristic temperature is addition to the transition temperature. This soft-mode temperature is identified with the minimum of the soft-mode frequency and results from the appearance of the 1-d soliton propagation along the chains. 1 ref., 3 figs.

10438 **(MLM—3398(OP)) NMR investigations of aging effects in palladium tritide.** Abell, G.C.; Attalla, A. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1986. Contract AC04-76DP00053. 19p. (CONF-8610177—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003026.

From Solid science meeting; Livermore, CA, USA (6 Oct 1986).

Using pulsed NMR techniques, relaxation times for triton, proton, and ^{3}He nuclei in recently synthesized PdH/sub x/ and PdT/sub x/ samples were measured as a function of temperature in the range $100 \leqq T \leqq 300^\circ K$. Rigid lattice second moments ($T \simeq 100^\circ K$) were also determined. These results provide baseline information for an extended study of aging effects of PdT/sub x/. 6 refs., 7 figs., 2 tabs.

10439 **(UCID—20934) The effect of target thickness on x-ray production by FXR [Flash X-Ray Machine].** Back, N.L. (Lawrence Livermore National Lab., CA (USA)). 22 Oct 1986. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003606.

The electron-photon transport code SANDYL has been used to calculate the x-ray flux for a simplified Flash X-Ray Machine (FXR) bullnose geometry. Four different thicknesses (24.5, 36.75, 49, and 61.25 mils) were used for the tantalum bremsstrahlung target in order to study the effect of target thickness on the FXR output. The calculations were performed for a parallel 17 MeV electron beam, and the resulting angular distributions were then used to compute the forward flux for the more realistic case of a converging beam. Over the range of thicknesses studied, the x-ray energy content per steradian on axis was essentially independent of target thickness. The main reason for this is that, while the total x-ray flux coming out of the target increases with increasing target thickness, the angular width of that flux also increases. The implications for target wheel design are discussed. 3 refs., 7 figs.

6561 Superconductivity

REFER ALSO TO CITATION(S) 9382, 9383, 9401, 9435, 9461

10440 **(FRNC-TH—2284) Current distribution and losses inside a superconducting multiwire composite submitted to a variable magnetic field.** Ciazynski, D. (Paris-6 Univ., 75 (France)). Nov 1985. 266p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE87750756.

The work performed concerns essentially the current saturation effect of superconducting filaments part of a composite, on current distribution and losses, created by a varying magnetic field, transverse to the composite. Induced current and losses created in the composite are first studied in an homogeneous medium. The theoretical resolution is then made from Maxwell equations and characteristic equations of the medium. Then, from the homogeneous model a complete system of equations is got for four cases: the steady state conditions (constant induced current) for a composite not carrying currents; the non-homogeneous composites in the same conditions; the third case is about influence of carried current in steady-state conditions, and finally the transient regime. A method of numerical solution allows to calculate currents and losses dissipated inside the composite. In every case, an experimental study completes the theoretical studies.

10441 **(LA-UR—86-3847) Heavy-electron materials.** Fisk, Z.; Ott, H.R.; Smith, J.L. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 15p. (CONF-8605199—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002908.

From 6. CNLS annual conference on nonlinearities in condensed matter; Los Alamos, NM, USA (4 May 1986).

De Haas-van Alphen results demonstrated the existence of a Fermi surface at sufficiently low temperature and show that the entire Fermi surface involves heavy electrons. The phase transitions in their heavy-electron state are discussed. These are either magnetic or superconducting. 38 refs., 6 figs., 2 tabs. (WRF)

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 9542, 10228, 10265, 10407, 10665

10442 **(CEA-CONF—8245) Schroedinger equation from 0 (h/2π) to o(h/πinfinity).** Voros, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Aug 1985. 24p. (CONF-8508207—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750256.

From Symposium on path integrals from meV to Mev; Zif-Bielefeld, F.R. Germany (5 Aug 1985).

The Balian and Bloch idea, that the semiclassical treatment of the Schroedinger equation can be carried out exactly to all orders, o(h/2πinfinity), has been explicitly confirmed upon the time-independent equation with a polynomial potential V(q) in one degree of freedom. The global analytic structure of certain functions, which encode the full eigenvalue distribution, has indeed been computed in great detail with the complex WKB method, yielding a structure called a resurgence algebra. In the special case $V(q) = q^2$sub(M), this leads to sum rules for the eigenvalues, which have been verified numerically. Inasmuch as the leading order 0(h/2π) of the WKB expansion amounts to the stationary phase evaluation of the Feynman path integral, it is a yet unsolved challenge to reproduce our results by an exact analysis of this path integral using a generalized saddle-point treatment.

10443 **(DOE/ER/13147—2-Pt.7) Using mutual information to estimate metric entropy.** Fraser, A.M. (Texas Univ., Austin (USA)). Sep 1985. Contract AS05-84ER13147. 10p. (CONF-8509203—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87000763.

From International conference on dimensions and entropies in chaotic systems; Pecos River, NM, USA (11 Sep 1985).

A technique for deriving the metric entropy of strange attractors from estimates of the mutual information in scalar time series is presented and applied to experimental and model data. The results are accurate enough to determine if a system is chaotic. 13 refs., 3 figs.

10444 (IAE—1966/Cyfronet/PM/A) **Simple waves in quasilinear hyperbolic systems. Part 2. Riemann invariants for the problem of simple waves interactions.** Grundland, A.M.; Zelazny, R. (Institute of Atomic Energy, Otwock-Swierk (Poland)). 1983. 58p. Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

A generalization of Riemann invariants method to the case of nonhomogeneous system of eqs. has been formulated. We have discussed the necessary and sufficient conditions for the existence of Riemann invariants. We perform the analysis using the apparatus of differential forms and Cartan theory of systems in involution. The problem has been reduced to examining Pfaff forms. We have considered the connections between the structure of the set of integral elements and the possibility of a construction of special classes of solutions depending on k arbitrary function of one variable. The solutions can be interpreted physically as the interactions between k-simple waves on a simple state. We have proved that in the case of interaction of many simple waves described by Riemann invariants, a conservation law for the type and quantity of waves holds. It has also been shown that such a solution resulting from the interaction of many simple waves propagating on the simple state decays for a large time in the exact way into simple waves (of the same kind as those entering the interaction) on the state. The Cauchy problem for the nonlinear superposition of k-simple waves has been formulated. Theorems useful for this problem have been given. The functorial properties of eqs. determining Riemann invariants have been described. The last part of the work contains analysis of some examples of the solutions of nonhomogeneous magnetohydrodynamics equations from the point of view of the method described above.

10445 (IFVE-OTF—85-184) **Experimental confirmation of relativistic theory of gravity in radio signal delay effect.** Logunov, A.A.; Loskutov, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700179.

In the framework of the relativistic theory of gravity (RTG) the expression for the radio signal delay time in the gravitational field has been obtained. When the planet Mercury, being in the superior conjunction with the Earth, is the radio signal reflector, the radio signal delay is shown to exceed the corresponding delay, predicted by the GTR by about 20 mcsec. Experimental data are in good agreement with the RTG. 4 refs.

10446 (INIS-mf—10512, pp 11) **Fractional quantum numbers in solid state physics.** Stoermer, H.L. (Bell Labs., Murray Hill, NJ, USA). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10447 (INIS-mf—10512, pp 20) **Magnetic resonance of free neutrons.** Badurek, G.; Rauch, H. (Technische Univ., Vienna, Austria. Inst. fuer Experimentelle Kernphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10448 (INIS-mf—10512, pp 58) **Scattering kernel expansion into the natural collision- and scattering angles, in the non-linear Boltzmann equation.** Schuerrer, F. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10449 (INIS-SU—353, pp 3-7) **Brownian movement of quantum particles in a non-equilibrium medium.** Zaikin, A.D. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780034.

Kratkie Soobshcheniya po Fizike.; (No. 6).

In Experimental and theoretical physics. Collection.

A theory describing behaviour of quantum particles interacting with a non-equilibrium medium is developed. High efficiency action and Langevin equation are obtained. In a stationary case Green-Keldish functions for such particles are calculated. 5 refs.

10450 (INIS-SU—353, pp 36-41) **Stochastic quantization and perturbation theory.** Gadzhiev, S.A.; Fajnberg, V.Ya. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780034.

Kratkie Soobshcheniya po Fizike.; (No. 6).

In Experimental and theoretical physics. Collection.

Translation-invariant diagram technique is developed in stochastic quantization method. Specific features at generalizing this technique to calibration theory are studied. 11 refs.

10451 (INIS-SU—356, pp 38-44) **Relativistic oscillator wave functions and different basis of the SL (2,R) group representations.** Atakishiev, N.M.; Mir-Kasimov, R.M. 1985. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87780027. (JINR-N—11-85).

In JINR rapid communications. Collection.

The exactly soluble problem for the finite-difference Schroedinger equation in the relativistic configurational space is considered. The potential of the problem is the generalization of the nonrelativistic oscillator potential. In particular the dynamical group of symmetry for the finite-difference Schroedinger equation coincides with the dynamical group of symmetry of the nonrelativistic oscillator. The reaization of dynamical group in terms of the wave fuction of the finite difference Schroedinger equation is used for establishing the connection between the matrix elements of representations for different reductions and for matrix elements of the boost. 13 refs.

10452 (INIS-SU—357, pp 5-12) **Damping of collective modes as open quantum systems.** Sandulescu, A.; Scutaru, H. 1985. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number DE87780028. (JINR-N—10-85).

In JINR rapid communications. Collection.

In the framework of the Lindblad theory for open quantum systems the following results are obtained: a generalization of the fundamental constraints on quantum mechanical diffusion coefficients which appear in the corresponding master equations, a generalization of the Hasse pure state condition and a generalized Schroedinger type nonlinear equation for an open system. Also, the Schroedinger, Heisenberg and Weyl-Wigner-Moyal representations of the Lindblad equation are given explicitly. Based on these representations, one shows that various master equations for the damped quantum oscillator used in the literature for the description of the damped collective modes in DIC are particular cases of the Lindblad equation and that the majority of these equations do not satisfy the constraints on quantum mechanical diffusion coefficients. 14 refs.

10453 (INP—1206/PL, pp 39-41) **Application of second quantization in the theory of many-quantum transitions.** Nosel, W. (Uniwersytet Jagiellonski, Krakow, Poland. Inst. Fizyki). 1983. (In Polish). NTIS (US Sales Only), PC A11/MF A01. File Number DE87780035. (CONF-8212113—).

From 15. national seminar on nuclear magnetic resonance and its applications; Cracow, Poland (1 Dec 1982).

Theory of many-quantum transition is described in second quantization terms. Form of density operator is found and absorption resonance signal is given.

10454 (INP—1206/PL, pp 50-54) **Quantum processes detection.** Szpilecki, J. 1983. (In Polish). NTIS (US Sales Only), PC A11/MF A01. File Number DE87780035. (CONF-8212113—).

From 15. national seminar on nuclear magnetic resonance and its applications; Cracow, Poland (1 Dec 1982).

Interaction between radiation (electromagnetic wave) and detector is described in second quantization terms. The electromagentic field is assumed to be homogeneous and on this assumption the calculations are carried out.

10455 (INP—1206/PL, pp 55-58) **Optimal Markov's filter for quantum mechanics processes. Supplementary notes.** Szpilecki, J. 1983. (In Polish). NTIS (US Sales Only), PC A11/MF A01. File Number DE87780035. (CONF-8212113—).

From 15. national seminar on nuclear magnetic resonance and its applications; Cracow, Poland (1 Dec 1982).

In order to solve the problem of measurements of non-commutating mechano-quantum quantities "at the same time" optimization method is described for the harmonic oscillator.

10456 (INP—1206/PL, pp 59-63) **Calculation of mean product of normal ordered operators in different times case.** Szpilecki, J. 1983. (In Polish). NTIS (US Sales Only), PC A11/MF A01. File Number DE87780035. (CONF-8212113—).

From 15. national seminar on nuclear magnetic resonance and its applications; Cracow, Poland (1 Dec 1982).

Assuming the model of maser in Lousell's approach, the mean product of normally ordered operators is calculated. Evolution operator equations are solved too by means of Laplace's integration. The time functions are also found.

10457 (INP—1206/PL) **Proceedings of the 15. national seminar on nuclear magnetic resonance and its applications.** (Institute of Nuclear Physics, Krakow (Poland); Uniwersytet Jagiellonski, Krakow (Poland). Inst. Fizyki). 1983. 248p. (In Polish). (CONF-8212113—). NTIS (US Sales Only), PC A11/MF A01. File Number DE87780035.

From 15. national seminar on nuclear magnetic resonance and its applications; Cracow, Poland (1 Dec 1982).

Individual papers in these seminar proceedings have been abstracted separately.

10458 (INS—1967/P-8/PR/A) **New results in the external Milne problem in cylindrical symmetry. Part 1. One-group approximation.** Blenski, T. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1983. 50p. Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

The asymptotic flux and the extrapolation distance are calculated in the one-group cylindrical Milne problem ("black" cylinder of radius R immersed in an infinite homogeneous medium characterized by $C < 1$). The methods are based both on the reseults of Case's elementary solutions approach in a plane geometry and on the classical perturbational and variational procedures. For large and small R the extrapolation distance is given in the form of asymptotic expansions. For intermediate values of R a version of the variational method is developed. For two examples ($c = 0.95$ and $c = 0.90$) numerical results are presented. The convergence of the methods and the comparison in the regions where both may be applied indicate that sufficient accuracy is achieved.

10459 (INS—1968/P-8/PR/A) **New results in the external Milne problem in cylindrical symmetry. Part 2. Two-group approximation.** Blenski, T. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1983. 48p. Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

The asymptotic flux and the extrapolation distances are calculated in the two-group cylindrical Milne problem. The methods are based on the recent results in the elementary solutions approach in the two-group theory in plane geometry, and on the classical perturbational and variational procedures. As in part 1 for large and small R, the extrapolation distances are given in the form of asymptotic expansions. For intermediate values of R a version of the variational method especially adopted for the two-group theory is applied. For two examples (both for $x = 1$) numerical results are presented. The convergence and the comparison confirm that sufficient accuracy is achieved.

10460 (IPNO-DRE—86-03) **Some properties of the functions satisfying Bell's inequalities in relation to quantum mechanics.** Roussel, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1986. 14p. (CONF-8509231—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750779.

From Microphysical reality and quantum formalism; Urbino, Italy (25 Sep 1985).

A detailed comparison of Bell's inequalities (BI) and quantum mechanics (QM) in an EPRB situation is given. It is first shown that QM violates the original (3 directions) or generalized (4 directions) BI almost everywhere. The properties of functions satisfying the original BI are then derived and compared to QM predictions. Finally, the behaviour of functions which satisfy BI and attempt to fit QM is described. Altogether, an incompatibility is shown to be stronger than that resulting from just the usual examination.

10461 (ITP—85-29-E) **Applications of the phase function method ideas for the investigation of the two- and three-body system properties.** Petrov, N.M.; Pushkash, A.M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700178.

In accordance with the main idea of the phase function method the two-body off-shell scattering amplitudes are considered as the limit of the scattering amplitude sequence corresponding to the sequence of the R-radius cut-off potentials. The explicit analytical expression for the scattering amplitudes function is obtained in the case of separable potentials, due to which the three-body problem is investigated. 15 refs.; 4 figs.

10462 (Juel-Spez—316, pp 228-231) **Nonlinear dynamics of one-dimensional spin systems.** Mikeska, H.J. (Hannover Univ., Germany, F.R. Inst. fuer Theoretische Physik). Jun 1985. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE87750303. (CONF-8410450—).

From Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology; Maria Laach, F.R. Germany (1 Oct 1984).

The article reports on some theoretical projects to the dynamics of quasi one-dimensional magnets, which exceed the Sine-Gordon approximation: 1) Out-of-plane fluctuations in classical ferromagnets, 2) The classical antiferromagnet, 3) The specific heat in one-dimensional ferromagnets, 4) Solitons on the discrete lattice. (BHO).

10463 (KEK—85-4, pp 83-105) **Supergravity theories.** Uehara, S. (Hiroshima Univ., Takehara, Japan. Research Inst. for Theoretical Physics). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

Of all supergravity theories, the maximal, i.e., $N = 8$ in 4-dimension or $N = 1$ in 11-dimension, theory should perform the unification since it owns the highest degree of symmetry. As to the $N = 1$ in $d = 11$ theory, it has been investigated how to compactify to the $d = 4$ theories. From the phenomenological point of view, local SUSY GUTs, i.e., $N = 1$ SUSY GUTs with soft breaking terms, have been studied from various angles. The structures of extended supergravity theories are less understood than those of $N = 1$ supergravity theories, and matter couplings in $N = 2$ extended supergravity theories are under investigation. The harmonic superspace was recently proposed which may be useful to investigate the quantum effects of extended supersymmetry and supergravity theories. As to the so-called Kaluza-Klein supergravity, there is another possibility.

10464 (KEK—85-4) **Proceedings of workshop: toward unification and its verification.** Kazama, Y.; Koikawa, T. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Aug 1985. 198p. (CONF-8411278—). NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045.

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

Individual papers in these workshop proceedings are abstracted separately.

10465 (KFKI—1986-26/E) **New approach to the problem of chaotic repellers.** Szepfalusy, P.; Tel, T. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Roland Eoetvoes Univ., Budapest (Hungary). Inst. for Theoretical Physics). May 1986. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87700244.

It is shown that a smooth stationary distribution can be derived for 'coarse grained' repellers by compensating the local escape. This provides a convenient framework to investigate statistical properties of long chaotic transients. Furthermore, the procedure yields a powerful tool for calculating fractal dimensions. 14 refs.; 3 figs.

10466 (LYCEN—8555) **On nonbijective canonical transformations in mathematical physics.** Lambert, D.; Ronveaux, A.; Kibler, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Aug 1985. 4p. (CONF-8508117—5-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750760.

From 14. international colloquium on group theoretical methods in physics; Seoul, Korea (26 Aug 1985).

Published in summary form only.

10467 **Augmented langevin description of multiplicative noise and nonlinear dissipation in Hamiltonian systems.** Ramshaw, J.D.; Lindenberg, K. (Los Alamos National Lab., NM). *Journal of Statistical Physics;* **45**: No. 1/2, 295-307(Oct 1986).

The augmented Langevin approach described in a previous article is applied to the problem of introducing multiplicative noise and nonlinear dissipation into an arbitrary Hamiltonian system in a thermodynamically consistent way, so that a canonical equilibrium distribution is approached asymptotically at long times. This approach leads to a general nonlinear fluctuation-dissipation relation which, for a given form of the multiplicative noise (chosen on physical grounds), uniquely determines the form of the nonlinear dissipative terms needed to balance the fluctuations. In addition to the noise and dissipation terms, the augmented Langevin equation contains an addition term whose form depends on the stochastic interpretation rule used. This term vanishes when the stratonovich rule is chosen and the noise itself is of a Hamiltonian origin. This development provides a simple phenomenological route to results previously obtained by detailed analysis of microscopic system-bath models. The procedure is illustrated by applications to a mechanical oscillator with fluctuating frequency, a classical spin in a fluctuating magnetic field, and the Brownian motion of a rigid rotor.

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10468 (KFTI—84-21) **Dynamics of two-wave interaction of relativistic beam with the fragment of corrugated waveguide.** Ajzatskij, N.I.; Ostrovskij, A.O. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR); AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700190.

Non-linear stage of trasient processes in a relativistic generator with periodically corrugated waveguide is studied theoretically. It is shown that in interaction of an electron beam close to the transparence band boundary of the π-form with two spatial retarding structure harmonics, the efficiency of beam energy transformation into energy of microwave radiation increases essentially as compared to limiting values peculiar for the relativistic carcinotron. It is noted that the considered retarding structure possesses pronounced resonance properties. 14 refs.; 3 figs.

10469 (UCRL—95125-Rev.1) **Emerging nuclear energy systems: Economic challenge: Revision 1.** Nuckolls, J.H. (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 13p. (CONF-860601—11-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002378.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

Future nuclear energy systems may achieve substantially lower energy costs than those of existing fossil energy systems and comparable capital costs. Such low cost nuclear energy would provide a strong economic incentive to minimize the use of fossil fuels. If these low cost nuclear energy systems emerge in the next few decades, 21st century civilization may be able to avert potentially disastrous CO$_2$ induced global climate changes. 12 refs., 1 fig.

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REFER ALSO TO CITATION(S) 9649, 10148, 10165, 10305, 10608, 10610, 10611, 10613, 10615, 10643, 10649

10470 (CEA-CONF—8267) **Laser program development at CEL-V: overview of recent experimental results.** Buresi, E.; Coutant, J.; Dautray, R. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Nov 1985. 27p. (CONF-851128—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750262.

From 17. European conference on laser interaction with matter; Rome, Italy (18 Nov 1985).

A significant effort has been made recently at CEL-V to improve laser facilities. OCTAL, the eight beam, 2 kJ laser, has been equipped with phosphate glass and KDP frequency tripling systems. Phebus, a two beam 20 kJ neodymium glass laser based on NOVA technology was defined, built and will be tested in early 1986 in close collaboration with Lawrence Livermore National Laboratory. In the field of diagnostics, the development of soft X-ray emission analysis has been emphasized. Most of recent experimental results have been obtained at short wave-length (0.35 μm). They deal with: effect of non-uniform illumination, 2D hydrodynamics with either plane or spherical targets, and study of thermal transport inhibition.

10471 (CONF-870108—2) **Performance evaluation of the HEP, ELXSI and CRAY X-MP parallel processors on hydrocode test problems.** Liebrock, L.M.; McGrath, J.F.; Hicks, D.L. (KMS Fusion, Inc., Ann Arbor, MI (USA); Michigan Technological Univ., Houghton (USA)). 7 Jul 1986. Contract AC08-82DP40152. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86014102.

From 20. annual Hawaii international conference on system sciences; Honolulu, HI, USA (6 Jan 1987).

Parallel programming promises improved processing speeds for hydrocodes, magnetohydrocodes, multiphase flow codes, thermal-hydraulics codes, wavecodes and other continuum dynamics codes. This paper presents the results of some investigations of parallel algorithms on three parallel processors: the CRAY X-MP, ELXSI and the HEP computers. Introduction and Background: We report the results of investigations of parallel algorithms for computational continuum dynamics. These programs (hydrocodes, wavecodes, etc.) produce simulations of the solutions to problems arising in the motion of continua: solid dynamics, liquid dynamics, gas dynamics, plasma dynamics, multiphase flow dynamics, thermal-hydraulic dynamics and multimaterial flow dynamics. This report restricts its scope to one-dimensional algorithms such as the von Neumann-Richtmyer (1950) scheme.

10472 **(DOE/ER/53005—T1) Intense ion beam application to magnetic confinement fusion.** Sudan, R.N.; Hammer, D.A. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). 25 Nov 1986. Contract AC02-77ET53005. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003146.

The proposed research program involves experiments specifically concerned with physics issues that must be addressed in order to evaluate the applicability of ion rings to the Compact Toroid Program. We have successfully developed the technology for production and trapping of ion rings to the point that we can now undertake the experiments applying these rings to compact toroid research. One of our experiments, LONGSHOT, has already begun such an application experiment, and the other, IREX, will be making the transition to addressing primarily physics issues during the first year of the period covered by this proposal. The present status and our plans for both of these experiments are discussed in detail.

10473 **(DOE/ER/53221—1) Maryland controlled fusion research program: Annual progress report.** Ott, E.; Ellis, R.F.; Boyd, D.A.; Griem, H.R. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). [1986]. Contract FG05-86ER53221. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002440.

Brief summaries of theoretical work during this period are given. Research on the electron cyclotron emission diagnostics for mirror machines is also discussed. (MOW)

10474 **(GA-A—18637) Saturation of tearing modes with finite pressure.** Lee, J.K. (GA Technologies, Inc., San Diego, CA (USA)). Oct 1986. Contract AC03-84ER53158. 16p. (CONF-861239—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002387.

From Topical meeting on dissipative instabilities in toroidal devices (US/USSR exchange); Moscow, USSR (8 Dec 1986).

With finite pressure, the saturation of the current-driven tearing mode is obtained in three-dimensional nonlinear resistive magnetohydrodynamic simulations for tokamak plasmas. To effectively focus on the tearing modes, we exclude the perturbed pressure effects but include the finite equilibrium pressure effects. With this model, the linear growth rates of the tearing modes are found to be very insensitive to the equilibrium pressure increase. The nonlinear aspects of the tearing modes, however, are found to be very sensitive to the pressure increase in that the saturation level of the nonlinear harmonics of the tearing modes increases monotonically with the pressure rise. The increased level is associated with enhanced tearing island sizes or increased stochastic magnetic field region.

10475 **(IAE—4114/6) Method of electrodynamical momenta for calculating toroidal plasma equilibrium.** Zakharov, L.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700192.

A method for solution of plasma equilibrium problems in toroidal systems is described. The method is based on using natural coordinates and the system of non-linear ordinary differential equations derived by averaging Grad-Shafranov equation with harmonic functions. Efficiency of the method is conditioned by existence of equations of integrated combinations in the system so that solution of the equilibrium problem is reduced to successive integration the notion of solving differential equations in generalized quadratures is formulated. 20 refs.

10476 **(IAE—4115/6) Simple models for calculating plasma equilibrium in a tokamak.** Zakharov, L.E.; Pustovitov, V.D.; Semenov, S.B.; Subbotin, A.A.; Peral'to, Kh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700193.

Algorithms for plasma equilibrium calculation in tokamaks, based on the method of electrodynamic moments, are presented in details. Five specific equilibrium models, describing practically all variants of plasma configuration in tokamaks, are considered. 2 refs.; 2 figs.

10477 **(IAE—4116/6) On the transfer processes while cyclotron heating in tokamaks.** Shurygin, R.V.; Yushmanov, P.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700194.

A form factor in the expression for a absorbed power of resonance particles in a tokamak during cyclotron heating at ωΩsub(Ca) is calculated. Evaluations for possible mechanisms of radiative transfer, arising due to cyclotron wave-particle interaction, are obtained. It is pointed to possible concentration of particles near a resonance zone, that is the reason for plasma polarization and occurrence of a poloidal electric field. The "neoclassical" ion flow evaluations obtained in the presence of this field can apparently explain the observed difference in particle confinement during ICR and ECR plasma heating in the tokamak. 10 refs.; 3 figs.

10478 **(IAE—4155/7) High-frequency field distribution in the T-10 tokamak plasma during ion-cyclotron heating in case of weak absorption.** Vdovin, V.L.; Chesnokov, A.V.; Shapotkovskij, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700195.

Problems on plasma heating in the T-10 tokamak at the second harmonic of ion-cyclotron frequency ω = 2ωsub(Bi) are considered. Introduced plasma resistances for different systems of excitation waves in plasma are calculated under the assumption that the plasma touches a wave-guide wall. Long-wave plasma oscillations are well connected with the excitation system due to a trifle of opacity zones at plasma periphery. Field profiles are singled in the centre, that leads to energy release increase for differet plasma particles in central regions. 14 refs.; 10 figs.

10479 **(IAEA-CN—47/E-II-3-2) Neoclassical MHD equations, instabilities and transport in tokamaks.** Callen, J.D.; Qu, W.X.; Siebert, K.D.; Carreras, B.A.; Shaing, K.C.; Spong, D.A. (Wisconsin Univ., Madison (USA); Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 10p. (CONF-861106—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002405.

From IAEA international conference on plasma physics and controlled nuclear fusion research; Kyoto, Japan (12 Nov 1986).

The reduced equations of resistive MHD are extended for tokamaks into the experimentally relevant banana-plateau collisionality regime by adding parallel viscous stress effects. The resultant neoclassical MHD equations include: (1) rapid (~nu/sub i/) viscous damping of poloidal ion flows; (2) the trapped particle effects on the electrical conductivity and bootstrap current contributions to Ohm's law; (3) an enhanced (by B^2/B/sub θ/^{2}) perpendicular dielectric constant; and (4) all neoclassical transport effects. The types of neoclassical MHD instabilities that occur are analogous to the resistive-g, tearing and rippling modes of resistive MHD, but more virulent. Low mode number tearing type modes evolve into the usual nonlinear stage of resistive tearing modes. Turbulent transport due to medium mode number neoclassical MHD instabilities is estimated and shown to lead to energy confinement scalings similar to experimental results. Finally, the total transport in neoclassical MHD is shown to be comprised of equilibrium and transient Coulomb collisional effects (classical and neoclassical), convection-driven turbulent transport and magnetic flutter effects.

10480 **(INIS-mf—4754-No.33) International bulletin on atomic and molecular data for fusion.** No. 33. Smith, J.J. (ed.). (International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit). Jun 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87700191.

This bulletin deals with atomic and molecular data for fusion. A bibliography of the most recent relevant data is provided (273 literature pieces). An author index is included. 273 refs.

10481 (INIS-mf—10512, pp 56) **Equilibrium and stability of a reversed-field pinch with rectangular cross-sections.** Edenstrasser, J.W. (Innsbruck Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10482 (INIS-mf—10512, pp 57) **Direction resolution of a flat Langmuir probe characteristic by radon transformation.** Oertl, M. (Innsbruck Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10483 (INIS-mf—10512, pp 96) **Application of the hook method in plasma diagnostics.** Neger, T. (Technische Univ., Graz, Austria. Inst. f. Experimentalphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10484 (INIS-mf—10512, pp 55) **Slowing down of suprathermal ions in a fusion plasma.** Heinrichs, G.; Kernbichler, W.; Schoepf, K. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik; Innsbruck Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10485 (INIS-mf—10512, pp 58) **Stationary states of a collision-free Q-machine plasma.** Oertl, M.; Kuhn, S.; Krumm, P.; Crystal, T.L.; Schnupfer, N. (Innsbruck Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10486 (INIS-mf—10512, pp 95) **Cyclotron radiation in plasma physics.** Nassri, A.; Heindler, M. (Technische Hochschule, Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10487 (INIS-mf—10512, pp 95) **Influence of electron degeneracy on burnup of DT pellets in inertial fusion.** Kamelander, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Reaktorsicherheit). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10488 (INIS-mf—10512, pp 96) **Inertial fusion - physical models and numerical simulation.** Kamelander, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Reaktorsicherheit). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10489 (INIS-mf—10512, pp 57) **New interpretation of the electrostatic ion-cyclotron instability.** Mravlag, E.; Popa, G.; Schrittwieser, R. (Innsbruck Univ., Austria. Inst. fuer Theoretische Physik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10490 (INIS-SU—354, pp 60-64) **On harmonics of epithermal infrared radiation of a plasma focus.** Gribkov, V.A.; Isakov, S.I.; Romanov, A.B. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike.; (No. 11).
In Plasma physics. Collection.

Results of investigation of plasma focus epithermal radiation near plasma frequency and its second harmonic in the infrared region are presented. Infrared radiation have been investigated in the modes with one and two compressions. From the results obtained the conclusions have been made: plasma focus epithermal background radiation is due to power electron fluxes from preanode plasma; epithermal radiation harmonics spectra can be accounted for by representation on Langmuir turbulence: - anisotropic one - in case of low neutron yield (spontaneous scattering of Langmuir waves on electrons) and anisotropic one - in case of high neutron yield (Langmuir waves interaction); Langmuir wave energy density is low; thus the given process neither is responsible for anomalous relaxation of power electron fluxes in the plasma focus nor anisotropy of Langmuir turbulence itself arrising in case of high neutron yield. 4 refs.; 2 figs.; 1 tab.

10491 (INIS-SU—354, pp 24-27) **On turbulent transport across a magnetic field in a plasma.** Kuprin, A.V.; Silin, V.P. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike.; (No. 11).
In Plasma physics. Collection.

By means of ion-acoustic turbulence the formulas for determining electron heat flux and electron current across a magnetic field caused by longitudinal as well as transverse gradients of temperature, density and electric field are derived. 7 refs.

10492 (INIS-SU—354, pp 47-51) **Parametric excitation of low-frequency circularly polarized magnetostatic waves in a plasma.** Berru, M.K.; Gorbunov, L.M. 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780038.

Kratkie Soobshcheniya po Fizike.; (No. 11).
In Plasma physics. Collection.

In case of investigations of ionospheric and laser plasma particular attention is given to the problem of parametric instabilities developing in the vicinity of the critical concentration point. In this paper one more mechanism of instability arising during propagation of a circularly polarized pumping wave in a mgnetized plasma with concentration close to critical is analyzed. It is shown that in the field of a circularly polarized wave pumping with a frequency close to Langmuir electrons frequency a parametric instability is possible as a result of which Langmuir waves and low-frequency helical magnetostatic disturbances increase. Thresholds and increments of instability are determined. 4 refs.

10493 (INS—1987/P-5/PP/B) **Opto-electronic arrangement for investigation of spectral line profiles and its application for diagnostics of a pulse generated plasma.** Chyrczakowski, S.; Komar, W.; Melzacki, K. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1983. 28p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

An opto-electronic arrangement for investigation of spectral line profiles, based on a glass, long-focus spectrograph, has been constructed. A fast Kerr cell has been used as a shutter. A spectrum has been photographed throughout an image intensifier on a high-speed film. This set-up enables the ascertaining of the spectrograms with an exposure time of 50 ns. They have the 150 A range, which can be shifted within the 4400-670-A spectral region. A chain: monochromator-photomultiplier-oscilloscope is an integral part of the whole system, giving the oscillograms of the light intensity on the selected wavelength. A time marker of the opening of the shutter is imposed on the spectral line intensity oscillograms. The set-up presented here has been applied to the diagnostics of a plasma generated in the PF-20 plasma-focus device. A spectrum of light emitted by a deuterium plasma has been examined in the 4950 A line. Examples of the 50-ns spectrograms are shown. The spectral distributions of intensity of light, which had been obtained from the spectrograms are also presented. In particular, the D 4860 A line profiles in various moments of time are given, and then the electron density as a function of time in a plasma-focus discharge is demonstrated.

10494 (IPP—6/263) **Entropy principle for tokamak profiles.** Pfirsch, D.; Pohl, F. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jul 1986. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750328.

A variational principle is proposed which is called "entropy principle" and which aims at yielding relations between the density profile n(x) and the temperature profile T(x). It can be shown by comparison with experimental findings that tokamak plasmas indeed have the tendency to relax to such states in which these relations hold.

10495 (IPP—III/113) **Investigation of the parameters in the boundary plasma of ASDEX by means of a Langmuir probe.** Lenoci, M.; Haas, G. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jul 1986. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87750331.

The electron temperature and density were routinely measured at the edge of the ASDEX main plasma by means of a fast moving triple probe which gives the saturation current and Tsub(e) on line. These measurements were made in ohmically heated discharges and during neutral beam injection in order to study the radial dependence of the plasma parameters in the boundary layer and the effects of auxiliary heating on it. During lower hybrid application we observed strong poloidal and toroidal deviations in the floating potential that inhibit the operation of a triple probe. To investigate these effects, we used double probes and floating potential measurements. The most important reason, but not the only one, for these floating potential inhomogeneities are changes in the electron temperature of typically 10-20 eV over a distance of a few milliseconds.

10496 (IPPJ—725, pp 210-221) **Multiple inner shell vacancies in laser-irradiated Au plasma.** Kiyokawa, S.; Yabe, T.; Miyanaga, N.; Okada, K.; Hasegawa, H.; Mochizuki, T.; Yamanaka, T.; Yamanaka, C.; Kagawa, T. (Osaka Univ., Suita, Japan. Inst. of Laser Engineering). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The forteen line spectra in 3 - 4 keV from laser-irradiated Au plasma were identified by the relativistic Hartree-Fock-Slater method and were attributed to the multiple inner-shell vacancies in 3psub(1/2) (or 3psub(3/2)) shell and N shell. The splitting of two groups of lines was about 400 eV and was found to be due to the spin-orbit interaction in 3p shell.

10497 (IPPJ—725, pp 192-198) **Electron loss process and cross section of multiply charged ions by neutral atoms.** Karashima, S.; Watanabe, T. (Science Univ. of Tokyo, Japan. Faculty of Engineering). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The significance of experimental and theoretical results on the electron loss and capture of ions in matter plays an important role in the charge equilibrium problems of fusion plasma physics and of accelerator physics. In the report, we calculate electron stripping cross section by using the binary encounter approximation (BEA). Our treatment of the electron loss process is based on BEA, in which the nucleus of B screened by the surrounding electrons collides with electrons in the ion A sup(q+). The basic approximation in EBA is that the ion interacts with only one electron or nucleus of the target atom at a time. In the calculation for Li sup(2+) + H, we have found that EBA will give approximately reliable results.

10498 (IPPJ—725, pp 136-150) **Stability of ion distribution in strong ion shock structure.** Abe, Kanji; Sakaguchi, Gyo. (Tokyo Univ., Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The structure of strong ion shock wave propagating in fully ionized plasma is analyzed. To do this we have the microscopic approach employing the Fokker-Planck equation. Examination on the stability of the ion distribution in the shock structure is indispensable. The Fokker-Planck equation is solved to determine the ion distribution in the shock structure. The method of the solution to the Fokker-Planck equation is the same as that in the preceeding paper. The stability of ion distributions is then examined, and if the distribution is unstable, the growth rate of instability is calculated. Then, the characteristic time of the quasilinear process modifying the distribution to a certain extent is estimated and compared to the ion-ion collision time.

10499 (IPPJ—725, pp 151-157) **On the heat flux derived by the moment method in Lorentzian plasma between hot and cold walls.** Ogasawara, Masatada; Fukano, Azusa. (Keio Univ., Yokohama, Japan. Faculty of Science and Technology). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

Reason of disagreement is considered of two expressions for heat fluxes. One is the expression obtained by taking special limit of a general expression for the heat flux, which holds for arbitrary values of collisionality parameter L/lambda, lambda being the mean free path, derived by the moment method in the Lorentzian plasma between hot and cold walls (heat baths) separated by the distance L. By the special limit, we mean to take the collisional limit (L/lambda → infinity) and Tsub(c)/Tsub(h) → 1, where Tsub(c) and Tsub(h) are the temperatures of cold and hot walls. The other is the one derived by Landshoff, which is exact for the Lorentzian plasma in the linear theory. The difference comes from the nonlocal nature of the former heat flux, while Landshoff's one is based on the local nature.

10500 (IPPJ—725, pp 186-190) **Pulse effect in a light ion beam propagation through a z-discharge plasma channel.** Kato, Tomokazu. (Waseda Univ., Tokyo, Japan. School of Science and Engineering). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The modulation of wave form of an intense ion current pulse propagating through a z-discharge plasma channel is investigated using the Fourier series. The ion electron collisions are taken into account by the aid of Krook type collision term, while the ion ion collisions are neglected.

10501 (IPPJ—725, pp 158-185) **Integral representation for nonlinear heat transport.** Kishimoto, Y.; Mima, K.; Haines, M.G. (Osaka Univ., Suita, Japan. Inst. of Laser Engineering). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

In this paper, we propose a new integral representation of the distribution function from which the heat flux is obtained. Also shown is that the integral formula removes the difficulties such as the divergent character of expansion coefficients occurring in the previous differential formula. The local distribution function is expressed by the convolution of the local Maxwellian distribution f sub(M)(x) and the integral Kernel w(x, x') and derived directly from the Fokker-Planck equation with the Krook type operator in the electron energy relaxation. We first describe the basic assumption and basic equations. The integral expression for the solution of F-P equation is then given. We apply the integral formula to a steady state boundary problem.

10502 (IPPJ—727, pp 67-72) **Electron dynamics and transport in a mirror field.** Irie, Haruyuki; Hatori, Tadatsugu. (Nihon Univ., Tokyo. Dept. of Physics). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

The nonlinear dynamics and the radial transport of an electron in a magnetic mirror field are considered in the presence of an electrostatic monochromatic wave. It is found that a stochastic heating and a stochastic radial diffusion of electrons can simultaneously occur due to the nonlinear interaction between two motions, one is the bounce motion in the mirror and the other is the motion by the monochromatic wave. Three types of dependence of the diffusion coefficient on the wave amplitude are obtained which are different from that derived by the quasilinear theory.

10503 (IPPJ—727, pp 20-27) **RF-section - summary report.** Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

The emphasis in this working session was to address the problem of how radial transport in axisymmetic systems is induced by azimuthally non-uniform RF heating. The group chose to confine itself to axisymmetric systems for two reasons. First is that all of the existing ICRF codes used to model the RF field structure in the plasma use axisymmetric magnetic field geometry. Second, axisymmetric systems allow us to isolate the breaking of azimuthal symmetry by RF mechanisms from symmetry breaking by non-axisymmetric magnetic field configuration. The group decided as two different topics having to do with enhanced ion radial transport by non-uniform ICRH : (1) creation of stationary azimuthal electric field by E tilde effects, (2) angular monmentum input to plasma by rotating RF fields.

10504 (IPPJ—727, pp 32-42) **Plug and thermal barrier potential formation in Gamma 10.** Katanuma, I. (Tsukuba Univ., Sakura, Ibaraki, Japan. Plasma Research Center). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

Tandem mirror Gamma 10 employs a thermal barrier to insulate the electrons in the end plugs from those in the central cell. Generation of the thermal barrier in Gamma 10 requires the creation of a hot mirror trapped electron population, heated by electron cyclotron resonance heating. We calculate creation of the hot electron population when only second harmonic electron cyclotron resonance heating is included in the thermal barrier region. We then calculate the plug and thermal barrier potential formation when fundamental electron heating and neutral beam injection are added, using our bounce averaged Fokker-Planck code. To study the hot electron build up in the thermal barrier region theoretically and numerically, we include the quasilinear electron heating effects in the Fokker-Planck equation.

10505 (IPPJ—727, pp 61-66) **Bounce resonance heating and radial transport of electrons.** Sato, K.H.; Hatori, T. (Himeji Inst. of Tech., Hyogo, Japan). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

High-level fluctuation in the ion-cyclotron frequency range, which is difficult to be suppressed completely, has been observed in experiments of 2XIIB and TMX. Since the bounce frequency of electrons in magnetic mirrors is usually of the order of the ion-cyclotron frequency, electrons can be heated in the direction of the field line and the radial transport associated with the heating can be induced by the fluctuation. In this paper, calculations are made on the power transfer from the DCLC or the AIC mode to electrons through bounce resonance and moreover the radial transport induced by the waves is also claculated on the basis of a parabolic-well model. Analytical results are applied to experimental parameters of 2XIIB and plugs of TMX. It is found that the power transfer from the DCLC in 2XIIB is negligibly small compared with the electron-drag power, but that from the AIC in plugs of TMX can be comparable with it. A remarkable result is that the radial transport induced by these waves can be larger than the classical end-loss. It implies that the wave-enhanced radial transport can have a large influence on determination of radial profile of the ambipolar potential in plugs of tandem mirrors, especially in future experiment with high electron temperature.

10506 (IPPJ—727, pp 86-92) **Breakdown of intrinsic ambipolarity for the radial diffusion due to a rotating RF field.** Hatori, T.; Hojo, H. (Nagoya Univ., Japan. Inst. of Plasma Physics). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

An RF gas-ionization experiment was previously performed in the straight section of RFC device, and remarkable contrast was obtained between the two profiles of plasma density produced by left-hand and right-hand rotation of the RF magnetic field which was applied perpendicularly to the static field. The RF-induced radial transport is essential to this phenomena. The wave-induced radial flux, ΔGAMMA sub(r), tends to be intrinsically ambipolar and is in proportion to the rate of change of the average total theta-momentum of plasma. If ΔGAMMA sub(r) is positive, ions should diffuse outward relative to electrons, causing increase in the electrostatic potential at the outer region, and the density profile should become flat. If ΔGAMMA sub(r) is negative, the ion radial flux should be directed inward resulting in peaking of plasma density near the axis. Based on this idea, the theta-momentum balance is theoretically studied by using a V sub(theta)-moment of the Vlasov equation for species s, and a theoretical expression for <GAMMA sub(r) sup(s)> is obtained. To evaluate the sign of ΔGAMMA sub(r), the induced electric current ΔJ sub(r) is calculated and evaluation of the sign of ΔJ sub(r) is shown. It is found that the dominant electron flux originates from shear effect with the parallel mechanism while the dominant ion flux originates from compressional effect with the perpendicular dissipation mechanism. The analytical expression for ΔJ sub(r) is proposed for homogeneous density of neutral gas, and the typical value of the induced relative flow velocity is also presented.

10507 (IPPJ—727, pp 93-103) **Effect of ECH and ICH on ambipolar potential in NBT-1M.** Shoji, T. (Nagoya Univ., Japan. Inst. of Plasma Physics). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

The effect of the ambipolar potential on the ion transport is studied experimentally by introducing additional ECH and ICH power to the plasma in NBT-IM device. The magnetic fluctuation spectrum measurement shows that the fluctuation in the range of ion cyclotron frequency is increased by applying 8.5 GHz microwave power. When this power is introduced, the bulk ion temperature is raised and the high energy ion tail appears. The depth of the ambipolar potential well decreases until P sub(8.5) approximately 3 kw and then increases with the appearance of the high energy ion tail. One of the possible mechanisms for the change in potential below P sub(8.5) approximately 3 kw is attributable to the diffision enhanced by the low frequency electrostatic fluctuation which is observed to be decreased with 8.5 GHz microwave power. In order to study the plasma transport by changing the bulk ion temperature, twelve half turn antennas are used to heat both trapped and toroidally passing ions uniformly around the torus. The observations suggest that the change in ambipolar potential is closely related to the increase in ion temperature, and not to the heating configuration of the wave. The increment of the center potential by the ion heating is proportional to the increase in ion temperature. It is observed that the electrostatic potential is well shaped when T sub(e) > T sub(i) (ECH plasma) while it is hill shaped when T sub(e) < T sub(i) (ion heated plasma).

10508 (IPPJ—727, pp 11-19) **DC-section - summary report. Potential effect in transport due to non-axisymmetric confining field.** Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

The neoclassical transport working session concerned the following five topics : (1) multiple ambipolar roots, (2) non-Maxwellian distributions, (3) potential control, (4) large azimuthal precessions in tandem transition regions, (5) azimuthal electric field dependence along the magnetic field. The interest in (4) occurs because rapid spins alter the step per bounce to modify the ion transport coefficient in tandems. Topic (5) was mentioned because the poloidal electric field is driven by the radial magnetic drifts. The discussion of potential control (3) occurred because the bumpy torus and stellarator participants inquired as to whether a related technique might be used in their devices to control the operating regime. In order to discuss topic (1) effectively an attempt is made to construct a simple analytic model with no temperature gradients that exhibited multiple ambipolar operating points.

10509 (IPPJ—727, pp 125-130) **Neoclassical diffusion including ellipticity in a Heliotron-like configuration.** Wakatani, M. (Kyoto Univ., Uji, Japan. Plasma Physics Lab.). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

Discussions are made on the neoclassical transport in an l = 2 high-shear helical system which is similar to the Heliotron-E device with a large helical ripple, epsilon sub(h)(anti a) -- 0.3, compared to the toroidal ripple, epsilon sub(t)(anti a) -- 0.1. It has an average minor radius of anti a = 20 cm, an aspect ratio of R/anti a = 10 and a helical magnetic field of about 20 kG. It is well known that the l = 2 helical system has elliptic magnetic surfaces. The effect of ellipticity on neoclassical transport has not yet been studied. The author's concern is in the neoclassical diffusion for both the 1/ν regime and the plateau regime, where ν is the electron-ion collision frequency. The results in the 1/ν regime that have been published in NUCLEAR FUSION (Vol. 23, 1983) are summarized in the section 2 of this paper. The ellipticmagnetic surfaces with ellipticity larger than 1 improve transport in tokamaks. The effect of ellipticity on the plateau diffusion in an l = 2 helical system is discussed in the section 3.

10510 (IPPJ—727, pp 73-78) **Low frequency instability in a mirror field.** Ishida, Akio. (Niigata Univ., Japan. Dept. of Physics). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

The low frequency l = 1 mode was previously observed in the central cell of the tandem mirror machine (l is the azimuthal mode number). Although the l = 1 flute mode seems to be the most important candidate for this mode, the identification of the mode is not clear. Experimentally the bounce frequency of the ions between the mirrors is larger than the apparent frequency of the mode. In this paper, the effects of the finite length of the central cell or the bounce motion of the particles along with the magnetic field are studed theoretically. The full kinetic description is used here instead of the drift kinetic description since the latter misses the effect of the centrifugal force which drives the flute modes unstable. Thus the kinetic description leads to the matrix dispersion relation of the form O = det [Σ sub(j=e,i) Q sub(j) (m', n'; m, n; l)], where m' and m are the axial mode numbers, and n' and n the radial ones. It is then shown that the flute mode is the solution of the above equation and the finite length of the central cell or the bounce motion of the particles does not alter the conventional flute mode which is derived from the fluid description assuming no variation along the magnetic field.

10511 (IPPJ—727, pp 112-117) **Simulation studies on stability of hot electron plasma.** Ohsawa, Yukiharu. (Nagoya Univ., Japan. Inst. of Plasma Physics). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

Stability of a hot electron plasma in an NBT(EBT)-like geometry is studied by using a 2-1/2 dimensional relativistic, electromagnetic particle code. For the low-frequency hot electron interchange mode, comparison of the simulation results with the analytical predictions of linear stability theory show fairly good agreement with the magnitude of the growth rates calculated without hot electron finite Larmor radius effects. Strong stabilizing effects by finite Larmor radius of the hot electrons are observed for short wavelength modes. As for the high-frequency hot electron interchange mode, there is a discrepancy between the simulation results and the theory. The high-frequency instability is not observed though a parameter regime is chosen in which the high-frequency hot electron interchange mode is theoretically predicted to grow. Strong cross-field diffusion in a poloidal direction of the hot electrons might explain the stability. Each particle has a magnetic drift velocity, and the speed of the magnetic drift is proportional to the kinetic energy of each particle. Hence, if the particles have high temperature, the spread of the magnetic drift velocity is large. This causes a strong cross-field diffusion of the hot electrons. In the simulation for this interchange mode, an enhanced temperature relaxation is observed between the hot and cold electrons although the theoretically predicted high frequency modes are stable.

10512 (IPPJ—727, pp 107-111) **Guiding center distribution function and longitudinal invariant.** Todoroki, J. (Nagoya Univ., Japan. Inst. of Plasma Physics). Mar 1985. NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043. (CONF-8407189—).

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

Guiding center approximation (or drift approximation) is a well known and powerfull method to describe the charged particle motion in a strong magnetic field. But when one uses the drift kinetic equation to describe collective motion of plasma, one often meets some "paradoxes" or confusions: in some cases the results obtained by using drift equation do not agree with that obtained by using Vlasov equation. In order to solve these "paradoxes" the relation between the moments of real particle distribution and that of drift approximation is considered. In this consideration, the lowest order approximation is used for the drift equation of motion and it is assumed that the electric field is weak and time dependence is also weak. Thus a helpful theoretical expression, which describes the quasi neutrality condition, is derived. In addition, the bounce averaged equation of motion is considered using the same technique for deriving drift equation. In bounce averaged approximation the guiding center orbit is not on Jsub(parallel) = const. surface: Jsub(parallel) is an averaged orbit. The deviation of the drift orbit from Jsub(parallel) = const. surface is culculated in first order and theoretical expressions to describe the deviation are presented.

10513 (IPPJ—727) **Proceedings of the US-Japan workshop on transport in open-ended systems.** (Nagoya Univ. (Japan). Inst. of Plasma Physics; Nihon Univ., Tokyo. Dept. of Physics). Mar 1985. 132p. (CONF-8407189—). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780043.

From US-Japan workshop on transport in open-ended systems; Nagoya, Japan (30 Jul 1984).

Separate abstracts were prepared for each of the included papers. (MOW)

10514 **(KFTI—84-8) Study of the processes of plasma potential formation and particle transport under the effect of external variable electric field.** Grigor'eva, L.I.; Pashchenko, A.V.; Smerdov, B.I.; Chechkin, V.V. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1984. 37p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87700197.

Time and space behaviour of the plasma potential, occurring under the action of external variable electrostatic disturbance, is studied theoretically and experimentally. The characteristic frequency of disturbance change lies in the frequency range Ω <= ω sub(Bi) and ω sub(Bi) < or approximately Ω < or approximately ω sub(LH) (ω sub(Bi), ω sub(LH) are the ionic cyclotron and low hybride frequencies). It is shown that depending on disturbance amplitudes and plasma density there should be developed either potential oscillations with the frequency of an order of plasma ion frequency in a boundary layer, or short-term pulses of a positive polarity potential. Accelerated plasma diffusion across and along magnetic lines of force occurs in the second case. In experiments on high-frequency plasma heating in the mode of the Alfven or fast magnetoacoustic wave excitation this effect may be the cause for particle lifetime reduction or for the increased impurity admission into a discharge. 15 refs.; 89 figs.

10515 **(KFTI—84-15) Dynamics of a current discharge in the URAGAN-2 stellarator.** Gutarev, Yu.V.; Dikij, A.G.; Pashnev, V.K. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1984. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700196.

The results of experimental studies of dynamics of a current discharge in the triple "Uragan-2" stellarator-racetrack are presented. Magnetic field fluctuations, for which wave number ratios m/n=1/2; 2/1; 3/2; 3/1 are characteristic, are detected. Distribution of magnetic field fluctuations through a plasma filament has maximum near the discharge axis, where the width is minimal and the t sub(T)/tsub(st) ratio value is maximum. Plasma flow on the wall of a vacuum chamber has the same time behaviour as the amplitude of magnetic field fluctuations measured by external transducers. Impurities influence sufficiently on dynamics of a current discharge. 22 refs.; 7 figs.

10516 **(LBL—22498) The control of powerful neutral beams.** Theil, E.; Jacobson, V. (Lawrence Berkeley Lab., CA (USA)). 2 May 1986. Contract AC03-76SF00098. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003623.

While significant progress has been made in the development of neutral beams for the heating and sustaining of plasmas in large fusion experiments, the control of such devices has largely been a matter of hardware interlocks and operator experience. The need for computer-assisted control becomes more evident, however, with the initiation of multi-beamline experiments. This paper describes a software system that incorporates simple mathematical models coupled to Kalman filters for control of the high power (6 to 8 MW) beams currently under development at Lawrence Berkeley Laboratory's Neutral Beam Engineering Test Facility. Among the principal features of the system are: reduction of a large number of operator variables to just a few (usually one or two); the ability to describe most of the major neutral beams in use and under development; a foundation resting on statistical data analysis and control system principles rather than rules-of-thumb.

10517 **(LRP—237/84) Effect of RF heating on edge parameters in the TCA tokamak.** de Chambrier, A.; Collins, G.A.; Duperrex, P.A.; Heym, A.; Hofmann, F.; Hollenstein, C.; Joye, B.; Keller, R.; Lietti, A.; Lister, J.B. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland); Fribourg Univ. (Switzerland). Dept. of Plasma Physics; Zurich Univ. (Switzerland). Inst. of Inorganic Chemistry). Jul 1984. 30p. (CONF-840520—31). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900198.

From 6. international conference on plasma surface interactions in controlled fusion devices; Nagoya, Japan (14 May 1984).

Detailed scrape-off measurements during Alfven wave heating experiments (P/sub RF/ ~ 200 kW) in TCA are presented. The measurements are performed by means of electrical probes and by deposition probes fixed onto the antennae. It is shown that different antenna designs strongly influence the behavior of the boundary plasma. Even during low power RF heating experiments, it is found that the plasma-antenna interaction leads to a non-Maxwellian plasma. Low frequency density fluctuations are associated with gradient changes of the density and temperature profiles. High frequency fluctuations at the driving frequency and their harmonics are observed.

10518 **(LRP—238/84) An introduction to the theory of Alfven wave heating (with a side-glance on ICRF [ion-cyclotron-range-of-frequency]): Lecture notes.** Appert, K.; Vaclavik, J.; Villard, L. (Ecole Polytechnique Federale, Lausanne (Switzerland)). Jun 1984. 78p. NTIS (US Sales Only), PC A05/MF A01. File Number DE87900199.

This series of lectures is intended to be an introduction to the theory of Alfven Wave Heating (subsequently AWH). It will largely be based on the studies we have performed in the last few years in Lausanne, and is not meant to be a general review of work in the field. Especially, kinetic aspects of the theory will only briefly be touched upon.

10519 **(LRP—243/84) Consistent and non-consistent quasilinear models of lower-hybrid current drive.** Succi, S.; Appert, K.; Vaclavik, J. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). Jul 1984. 18p. (CONF-840616—25). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900193.

From International conference on plasma physics; Lausanne, Switzerland (27 Jun 1984).

Some theoretical aspects related to the problem of current generation by lower-hybrid waves are discussed. In particular, the influence of the spectral distribution of the rf power source and the effects of the anomalous Doppler interaction on the current generation are investigated.

10520 **(LRP—263/85) Study of the ideal MHD stability limit for JET: Final report.** Saurenmann, H.; Semenzato, S.; Succi, S.; Gruber, R.; Troyon, F. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). Jun 1985. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87900186.

The α particle heating power in JET fueled with 50%-50% DT, at the full field of 3.5 T and a full aperture plasma, can be approximated by P/sub α/ $\approx \beta^2$, where β is the volume averaged β in % and the power P/sub α/ is in megawatts. The objective is to obtain significant α particle heating. An α-power of 5 to 10 MW for an auxiliary heating power of 25 MW would appear to be already a very significant result. It would require a β between 2.2 and 3.2%, corresponding to an energy confinement time tau/sub E/ = 11 $\beta/(25 + \beta^2)$ (β in %) between 0.7 and 1 second always with 25 MW of heating. In both the experimental and theoretical studies made so far, record values of β coincide with record low q values, while JET is a low current, high q device. Since the required confinement time would be within reach if there were no degradation from the ohmic value, the existence of a β limit and how much it is, has become an important issue. Even more, as the dilution effects due to impurities further enhance the β required to reach the same α-power production.

10521 **(LRP—272/85) Theory of MHD waves.** Appert, K.; Collins, G.A.; Hellsten, T.; Vaclavik, J.; Villard, L. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). Sep 1985. 33p. (CONF-850927—10). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900189.

From 12. European conference on controlled fusion and plasma physics; Budapest, Hungary (2 Sep 1985).

This paper reviews recent developments in the theory of MHD waves in connection with radio-frequency heating in the Alfven Wave and Ion Cyclotron Ranges of Frequencies (AWRF, ICRF). The account is personal and focuses on the discussion of full wave solutions and the oscillation spectra in bounded, generally inhomogeneous, plasmas. Original results are presented concerning forced ICRF oscillations in a current-carrying torus. The effects on the wave structures of the equilibrium current, the size of the device, the minority concentration and the phenomenological damping are investigated. The resonant surfaces coincide with the magnetic surfaces as in the AWRF. The poloidal extension of the resonance is small in cases where a WKB approach is permitted so that there is no conflict between full wave solutions and the WKB method.

10522 **(LRP—276/85) MHD stability of toroidal confinement.** Troyon, F. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). Sep 1985. 19p. (CONF-850806—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900188.

From Course and workshop on basic physical processes in fusion plasmas; Varenna, Italy (26 Aug 1985).

Ideal MHD instabilities grow on a fast time scale given by the Alfven wave transit time across the major radius, usually in the microsecond range. These instabilities are driven by the current and the pressure. In tokamaks they lead to a current limitation and a pressure limit. The main results of the standard large aspect circular cross-section tokamak theory are presented (internal and external kinks). The effect of toricity is then demonstrated with some numerical results. The most important new element is the appearance of ballooning of modes across magnetic surface and pressure destabilization of the long wavelength external kinks. A semi-empirical scaling law which gives the maximum pressure which can be confined in a tokamak is presented with the supporting experimental status.

10523 **(LRP—287/86) Numerical studies of LH current drive in the presence of an electric field.** Succi, S.; Appert, K.; Vaclavik, J. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)). Apr 1986. 12p. (CONF-860412—15). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900204.

From 13. European conference on controlled fusion and plasma heating; Schliersee, F.R. Germany (14 Apr 1986).

The dynamical response of a homogeneous plasma to the simultaneous application of an rf power source and an opposing dc electric field is investigated by means of a 2-D + 2-D quasilinear code. The code evolves in time the electron distribution function, f(v/sub parallel/, v/sub perpendicular/, t) and the corresponding self-consistently generated wave spectral distribution W(k/sub parallel/, k/sub perpendicular/, t), both in two dimensions. The time evolution of the most relevant physical quantities, in particular the plasma current can therefore be straightforwardly evaluated.

10524 **(ORNL/TM—10150) Theory of resistive pressure-gradient-driven turbulence.** Carreras, B.A.; Garcia, L.; Diamond, P.H. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002984.

Saturated resistive pressure-gradient-driven turbulence is studied analytically and with numerical calculations. Fluid viscosity and thermal diffusivity are retained in the analysis and calculations. Such dissipation guarantees the existence of a stable, high-m dissipation range, which serves as an energy sink. An accurate saturation criterion is proposed. The resulting predicted pressure diffusivity scales similarly to the mixing length estimate but is significantly larger in magnitude. The predictions of the analytic theory are in good quantitative agreement with the numerical results for fluctuation levels.

10525 **(PPPL—2372) MHD stable regime of the tokamak.** Cheng, C.Z.; Furth, H.P.; Boozer, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003068.

A broad family of tokamak current profiles is found to be stable against ideal and resistive MHD kink modes for 1 $\leqq$ q(0), with q(a) as low 2. For 0.5 $\leqq$ q(0) $<$ and q(a) $>$ 1, current profiles can be found that are unstable only to the m = 1, n = 1 mode. A specific "optimal" tokamak profile can be selected from the range of stable solutions, by imposing a common upper limit on dj/dr - corresponding in ohmic equilibrium to a limitation of dT/sub e//dr by anomalous transport.

10526 **(PPPL—2376) A bounce-averaged Monte Carlo collision operator and ripple transport in a tokamak.** Albert, J.M.; Boozer, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1986. Contract AC02-76CH03073. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003069.

A bounce-averaged Monte Carlo operator is presented that simulates bounce-averaged perturbative Lorentz pitch angle scattering of particles in toroidal plasmas, in particular a tokamak. In conjunction with bounce-averaged expressions for the deterministic motion, this operator allows a quick and inexpensive simulation on time scales long compared to a bounce time. An analytically tractable model of transport due to toroidal magnetic field ripple is described.

10527 **(PPPL—2379) Experimental results from detached plasmas in TFTR.** Strachan, J.D.; Boody, F.P.; Bush, C.E.; Cohen, S.A.; Grek, B.; Grisham, L.; Jobes, F.C.; Johnson, D.W.; Mansfield, D.K.; Medley, S.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003070.

Detached plasmas are formed in TFTR which have the principal property of the boundary to the high temperature plasma core being defined by a radiating layer. This paper documents the properties of TFTR ohmic-detached plasmas with a range of plasma densities at two different plasma currents.

10528 **(PPPL—2385) Stabilization of sawtooty oscillation by island heating.** Park, W.; Monticello, D.A.; Chu, T.K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003075.

Using the compressible resistive MHD equations in a finite aspect ratio cylinder, it is found that the m = 1 mode (the sawtooth oscillation) can saturate when the pressure inside the magnetic island is higher than that of the original core plasma. The saturation condition is of the form $\Delta\beta$/sub p/ $\geqq$ 8 ϵ^{-1}/sub q = 1/ (1 - $q_0)^2$. This saturation effect can be used to actively stabilize sawteeth by heating the island and/or by cooling the core plasma. This mechanism together with a stabilizing toroidal effect may also explain recent lower-hybrid-wave-driven tokamak experiments where the saturation of sawteeth has been observed.

10529 **(PPPL—2388) Diffusion of a plasma subject to neutral beam injection.** Okuda, H.; Hiroe, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003076.

Two-dimensional numerical plasma simulations have been carried out in a uniform magnetic field to study the effects of neutral beam injection on plasma diffusion. Neutral beams injected across a magnetic field are assumed to be ionized by various ionization processes in a plasma. It is found that the suprathermal convective motion of a plasma generated by the injection of neutral beams is dissipated via anomalous viscosity, leading to enhanced cross-field diffusion. The diffusion coefficient depends weakly on the magnetic field and plasma density, similar to the diffusion due to thermally excited convective cells. The magnitude of the diffusion increases with the injection energy and is much larger than the thermal diffusion because of the presence of suprathermal plasma convection. It is shown that a similar anomalous plasma diffusion may occur in a plasma subject to radio frequency (RF) wave heating where only a localized region of plasma across a magnetic field is heated to a temperature much higher than the surrounding temperature. Theoretical investigations are given on the scaling of enhanced plasma diffusion.

10530 (PPPL—2393) **Impurity transport in ohmic- and neutral-beam-heated TFTR discharges.** Stratton, B.C.; Cohen, S.A.; Boody, F.P.; Bush, C.E.; Ellis, R. III; Fonck, R.J.; Fredrickson, E.; Grek, B.; Groebner, R.J.; Hill, K.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Oak Ridge National Lab., TN (USA); GA Technologies, Inc., San Diego, CA (USA); Massachusetts Inst. of Tech., Cambridge (USA). Francis Bitter National Magnet Lab.). Oct 1986. Contract AC02-76CH03073. 18p. (CONF-860522—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003071.

From 7. international conference on plasma surface interactions in controlled fusion devices; Princeton, NJ, USA (5 May 1986).

Impurity transport has been studied in ohmic- and neutral-beam-heated TFTR discharges by observation and numerical modeling of time evolutions of emissions from germanium injected using the laser-blowoff method. VUV spectral lines, the total radiated power, and soft x-ray intensities are compared with code predictions in which the impurity flux is assumed to have diffusive and convective terms. In plasmas with I/sub p/=1.4 MA and anti n/sub e/≃ 2.5 x 10^{13} cm^{-3}, little difference in transport between ohmic and beam-heated discharges is observed. At I/sub p/=0.7 MA and anti n/sub e/≃ 1.0 x 10^{13} cm^{-3}, a three-fold increase in the diffusion coefficient is found during beam heating.

10531 (SAIC—86/1904-PRI-105) **Beating a dead horse.** Catto, P.J. (Science Applications International Corp., Boulder, CO (USA). Plasma Research Inst.). Oct 1986. Contract AC03-76ET53057. 14p. NTIS, PC A02/MF A01. File Number DE87002681.

An alternate banana regime evaluation of the ion heat flux in tokamaks suggests that the neoclassical ion thermal conductivity in the large aspect ratio limit may be slightly more than twice the accepted value. For the same trial function, the uncertainty in the new coefficient is less than that of the conventional result. Furthermore, the arbitrary aspect ratio expression for the ion thermal conductivity in the banana regime is evaluated and found to be different than previously conjectured. In addition to arbitrary aspect ratio effects the treatment retains the classical contribution to the ion heat flux.

10532 (SAIC—86/1928-PRI-106) **Relativistic motion in the presence of cyclotron resonant electromagnetic waves.** Aamodt, R.E. (Science Applications International Corp., Boulder, CO (USA). Plasma Research Inst.). Oct 1986. 26p. NTIS, PC A03/MF A01. File Number DE87002636.

The relativistic collisionless motion of magnetically trapped electrons under the influence of an rf wave with frequency near an integral multiple of their ambient synchrotron frequency is studied analytically. A Hamiltonian formalism is used to determine the phenomena of losing or maintaining local resonance and the accumulation of dispersion of the electrons in the magnetic well as they heat. Sustenance of resonance is shown to be markedly dependent on the index of refraction of the wave and that the inherently relativistic detrapping effect can be important even for low energies and enhanced by low energy collisions.

10533 **Plasma expansion into regions of weak localized magnetic field in flowing plasmas.** Hill, J.; Raychaudhuri, S.; Lonngren, K.E. (The Univ. of Iowa, Iowa City, IA 52242). pp 74 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—).

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

Experiments on the expansion of a plasma into the wake region downstream and into the presheath region upstream created by a small magnetic dipole object inserted in a flowing plasma are described. The strength of the magnetic dipole is sufficient to magnetize the electrons but leave the ions unmagnetized. Accelerated ions are detected ahead of the expansion fronts in both the upstream and downstream regions. Initial measurements of the density profiles upstream from the magnet indicate a different spatial variation of the electron and ion densities.

10534 **Space charge effects and the double sheath near electron sources.** Intrator, T.; Cho, M.H.; Wang, E.Y. (Univ. of Wisconsin-Madison, Madison, WI 53706). pp 74 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—).

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

At the boundary between a plasma and a charged particle source, space charge effects determine the steady state balance of potential particle density and current flow. It was previously predicted that local potential extrema should exist for high enough particle emission. Total current has been measured by others and agrees only approximately with the simple theory. The authors have measured the local potential, i.e. the spatial shape of the double sheath between emitter and plasmas. Aside from the general interest in this problem, some electrostatic plasma probes operate in this regime. For example, the floating potential of an emissive probe in the limit of strong electron emission is often used to approximate the local plasma potential. Also, satellites at high altitude experience strong photo electron emission on the sunlit side. The authors present data showing the local plasma potential, near a hot electron emitting tungsten cathode. The diagnostics are single emissive probes in the limit of zero emission and a differential emissive probe pair. The data show the scaling between cathode emission and local potential profile and ambient plasma potential. Both DC and high frequency characteristics are shown.

10535 **High beta, hot electron experiments in constance B.** Smatlak, D.L.; Chen, X.; Lane, B.; Hokin, S.A.; Garner, R.C.; Post, R.S. (MIT Plasma Fusion Center, Cambridge, MA 02139). pp 84 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—). Contract AC02-78ET51013.

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

The Constance plasma is characterized by an interesting equilibrium configuration which is unique to hot electrons in a quadrupole mirror with a high radial well depth. The visible light images taken in the plasma afterglow suggest that the hot electron pressure profile is peaked off the axis and follows a baseball seam curve. The baseball seam is the shape of the drift surface of the deeply trapped hot electrons and the locus of points where the ECR heating is maximized. This equilibrium is stable over fractions of a second. A preliminary analysis suggests that this plasma should be unstable to MHD or precessional modes. The stable persistence of the plasma may be due to the strong self-fields which modify the topology of the confining fields. This equilibrium is being studied with magnetic probes, diamagnetic loops, and x-ray diagnostics.

10536 **Recent results from the Tara Tandem Mirror Experiment.** Smith, D.K.; Brau, K.; Casey, J.; Coleman, J.W.; Gaudreau, M.; Gerver, M.; Golovato, S.; Guss, W.; Horne, S.; Irby, J. (MIT Plasma Fusion Center, Cambridge, MA 02139). pp 85 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). (CONF-860523—). Contract AC02-78ET51013.

From 13. IEEE international conference on plasma science; Saskatoon, Saskatchewan, Canada (19 May 1986).

The Tara experiment has been constructed to investigate thermal barrier tandem mirror confinement in an essentially axisymmetric system. The device consists of a 10m long central solenoid bounded by two axisymmetric mirror cells where neutral beam injection and ECH are used to build up the plug plasma. Two quadrupole mirror cells outboard from the axisymmetric plugs are used to stabilize the machine. These anchor cells should stabilize low frequency instabilities when sufficient beta is established in their good curvature regions. The machine is designed so that central cell ions trapped by potentials in the axisymmetric plugs will never see the nonaxisymmetric magnetic regions, thereby eliminating the most basic source of neoclassical radial transport. Very recently, the major systems (six 1 MW neutral beams and four 200 KW gyrotrons) required for thermal barrier experiments have begun full operation. Experiments have shown build up of the required sloshing ion population in the plugs using approximately 150 amperes (drain) injection in each plug. Plug density with sloshing beam injection is n/sub m/≃ 3 x 10/sup 12/ cm/sup -3/ and 1.5 times higher at the ion turning points. The gyrotron ECH has produced hot electron populations of a few percent beta and densities n/sub eh/ of 1-5x10/sup 11/ cm/sup -3/.

10537 **Computer simulation of driven Alfven waves.** Geary, J.L. Jr. Austin, TX; Univ. of Texas (1986). 198p. University Microfilms Order No. 86-18,476.

Thesis (Ph. D.).

The first particle simulation study of shear Alfven wave resonance heating is presented. Particle simulation codes self-consistently follow the time evolution of the individual and collective aspects of particle dynamics as well as wave dynamics in a fully nonlinear fashion. Alfven wave heating is a possible means of increasing the temperature of magnetized plasmas. A new particle simulation model was developed for this application that incorporates Darwin's formulation of the electromagnetic fields with a guiding center approximation for electron motion perpendicular to the ambient magnetic field. The implementation of this model and the examination of its theoretical and computational properties are presented. With this model, several cases of Alfven wave heating is examined in both uniform and nonuniform simulation systems in a two dimensional slab. For the inhomogeneous case studies, the kinetic Alfven wave develops in the vicinity of the shear Alfven resonance region.

10538 **Asymmetries in plasma line broadening.** Joyce, R.F. Gainesville, FL; Univ. of Florida (1986). 123p. University Microfilms Order No. 86-18,644.

Thesis (Ph. D.).

Spectra lines have long been used as a density diagnostic in dense plasmas. Early theories produced hydrogenic spectral lines that were symmetric. At higher plasma densities, diagnostics could be improved if asymmetries were included. In this work, several sources of line asymmetry are considered. In Chapter One, the ion quadrupole interaction is studied. This is the interaction between the radiator quadrupole tensor and the electric-field gradients of the perturbing ions. The field gradients are calculated in an Independent Perturber Model. Two other asymmetry sources, fine-structure splitting and quadratic Stark effect, are considered in Chapter Two. Results of the combination of these effects follow in Chapter Three. Non-hydrogenic spectral lines are also asymmetric. In Chapter Four, a procedure for calculating the spectral lines from helium-like ions is outlined.

10539 **Turbulence in toroidally confined plasma: ion temperature gradient driven turbulence: dynamics of magnetic relaxation in current carrying plasma.** Lee, G.S. Knoxville, TN; Univ. of Tennessee (1986). 121p. University Microfilms Order No. 86-18,520.

Thesis (Ph. D.).

This thesis is devoted to two studies of low-frequency turbulence in toroidally confined plasma. Low-frequency turbulence is believed to play an important role in anomalous transport in toroidal confinement devices. The first study pertains the development of an analytic theory of ion-temperature-gradient-driven turbulence in tokamaks. Energy conserving, renormalized spectrum equations are derived and solved in order to obtain the spectra of stationary ion temperature gradient driven turbulence. Corrections to mixing length estimates are calculated explicitly. The resulting anomalous ion thermal diffusivity is derived and is found to be consistent with experimentally-deduced ion thermal diffusivities. The associated electron thermal diffusivity, particle and heat-pinch velocities are also calculated. The second study is devoted to the role of multiple helicity nonlinear interactions of tearing modes and dynamics of magnetic relaxation in a high-temperature current carrying plasma. To extend the resistive MHD theory of magnetic fluctuations and dynamo activity observed in the reversed field pinch, the fluid equations for high temperature regime are derived and basic nonlinear interaction mechanism and the effects of diamagnetic corrections to the MHD turbulence theory are studied for the case of fully developed, densely packed turbulence.

10540 **Experimental plasma physics in laser plasmas.** Turner, R.E. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 146 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors review high-power laser-plasma interaction experiments which have been performed at various laboratories. They briefly discuss the standard diagnostics in use, such as picosecond resolution streak cameras, as well as some of the more novel approaches to the difficult diagnostic problems. The experiments can be split into two categories: long wavelengths, such as from CO/sub 2/ lasers, and near-visible wavelengths, as from Nd:glass. The long-wavelength experiments, while not usually at as high a power as the shorter-wavelength ones, offer the possibility of direct measurement (via Thomson scattering) of plasma and ion waves. Direct scattered light measurements are awkward due to the relatively poor diagnostics available in the IR and require special techniques. Nd:glass experiments, especially frequency-doubled or -tripled ones, allow scattered light measurements in the special regime where the best instruments exist. The relatively high density of these plasmas makes direct measurements of plasma waves difficult at best. These plasmas may also be more collisional than the CO/sub 2/ formed ones.

10541 **Nonlinear interaction of laser light with plasmas.** Liu, C.S. (Univ. Maryland, Dept. of Physics & Astronomy, College Park, MD 20742). pp 146 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Parametric instabilities of laser light in plasmas are important nonlinear mechanisms by which the light can be anomalously absorbed or scattered. Those nonlinear processes dominantly affect the laser-plasma coupling efficiency in many laser-pellet fusion experiments and were the subject of intensive theoretical and experimental investigations.

10542 **Nonlinear cyclotron absorption and stimulated scattering.** Chung, T.H. Ann Arbor, MI; Univ. of Michigan (1986). 106p. University Microfilms Order No. 86-21,265.

Thesis (Ph. D.).

In electron cyclotron resonance heating (ECRH), wave sources heating a plasma linearly with respect to intensity; but as the intensity of ECRH gets larger, there might appear nonlinear effects that would result in cutoff of net absorption. This thesis uses quantum mechanical theory to derive a threshold microwave intensity for nonlinear absorption. The quantum mechanical theory estimates that the threshold microwave intensity for nonlinear absorption is about 10^5 watts/cm^2 for a microwave heating experiment (T/sub e/ = 100 ev, λ = 3,783 cm, B = 2.5 kG). This value seems large considering the present power capabilities of microwave sources ($10^2 \sim 10^3$ watts/cm^2), but for a low temperature plasma, this threshold will go down. There is another nonlinear phenomenon called stimulated cyclotron scattering that enhances photon scattering by electrons gyrating in a magnetic field. This is expected to prevent incoming photons from arriving at the central region of the fusion plasma, where absorption mainly takes place. Theory based on a photon transport model predicts that the threshold intensity for the stimulated cyclotron scattering is about 10^4 watts/cm^2 for the plasma parameters mentioned above. This value seems large also, but a longer wavelength of microwaves and a larger magnitude magnetic field, which will be the case in reactor type facilities, will lower the threshold intensity to levels comparable with the currently developed microwave sources.

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REFER ALSO TO CITATION(S) 9118, 9126, 9369, 9370, 9439, 9556, 9648, 9684, 10644, 10645, 10646, 10647, 10648

10643 (CAPE—2986) [MFTF-B NBPS, Shunt compensation network ceramic resistor assembly model (53 ohm): Engineering materials]. (Lawrence Livermore National Lab., CA (USA)). Contract W-7405-ENG-48. Jun 1986 OSTI, PO Bx 62, Oak Ridge, TN 37831. File Number TI87002629.

The drawing shows how a standard resistor was modified for use on the MFTF neutral beam source power supply. (MOW)

10644 (CEA-CONF—8410) In and out of pile tritium extraction from samples of lithium aluminates. Briec, M.; Abassin, J.J.; Botter, F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 22p. (CONF-860421—67). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750787.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Out of pile extractions after short irradiations concerned spheres of 3 to 5 mm diameter of different grain sizes. Extraction was conducted by flushing the samples either with pure argon or argon plus 0.1% hydrogen, in the temperature range 450°C to 850°C. Comparisons have also been made with $LiAl_50_8$; tritium release from this material is slower than from $LiAl0_2$.

10645 (CEA-R—5353) Influence of laser non-monochromaticity on stimulated Raman scattering in the laser plasma interaction. Bonnaud, G.; Reisse, C. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Apr 1986. 60p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750767.

Laser-irradiated plasma were simulated by means of an electromagnetic particle code 1 D 1/2. The aim was to study the influence of the laser wave spectral band width on stimulated Raman scattering. The results given were obtained with two different kinds of laser source: a purely monochromatic wave, used to study the effect of the plasma density, and a source with several distinct frequencies of the same intensity. The main results on the Raman scattering growth rate, the back-scattering and forward-scattering rates and the production of suprathermal electrons are given. The influence of irradiance and ion mobility is investigated. Part of this work was presented at the 14th Anomalous Absorption Conference held in May 1984 at Charlottesville (Virgina - United States).

10646 (CONF-860610—37) Comparison of three MHD flow control methods for self-cooled liquid metal blankets. Walker, J.S.; Picologlou, B.F. (Illinois Univ., Urbana (USA); Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 6p. NTIS, PC A02. File Number DE87002139.

From American Nuclear Society annual meeting; Reno, NV, USA (15 Jun 1986).

The heat deposition in a blanket is concentrated near the first wall. Uniform liquid-metal velocity in a self-cooled blanket is unattractive, because it leads to low mixed-mean temperature rise through the blanket and reduced power conversion efficiency. The objective of MHD flow control is to use the electromagnetic forces to produce a non-uniform velocity distribution which gives a uniform temperature distribution over the thickness of the blanket. Three methods of MHD flow control are presented here and the MHD pressure drops corresponding to the three methods are compared. One of the methods, although successful at achieving nonuniform velocity profiles, permits a large circulation of electric current which produces a high pressure drop. The analytical results do not indicate a clear choice between the other two methods. The analytical results do point to possible difference in heat transfer performance with the two methods.

10647 (CONF-860914—13) Study of eddy-current effects in the structure of the Westinghouse LCT coil. Luton, J.N.; Shen, S.S.; McManamy, T.J.; Wilson, C.T.; Ellis, J.F.; Dresner, L.; Wintenberg, R.E. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 5p. NTIS, PC A02. File Number DE87002189.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

This coil, designated WH, has a mechanical structure composed of a stack of aluminum plate segments held together with stainless throughbolts. When the magnetic flux through the coil is changed, voltage is induced in the structure, and to avoid excessive currents the design provided low-voltage insulation between plate segments. However, during construction it appeared that this anodizing layer may have been breached extensively. Electrical tests on delivery confirmed this, and supplemental instrumentation was added to the structure before the coil was installed in the test facility. The shorting raised concerns about increased refrigeration load, local overheating, and a change in dump characteristics. After installation, current ramps to 5 A showed magnetic diffusion time constants of 1.5 s at room temperature and 3.0 s at 20 K, an order of magnitude larger than for the other LCT coils. These latter coils have structural cases of stainless steel, which has an electrical resistivity 17 times that of the 2219-T87 aluminum used in the WH coil. In tests at operating currents, temporal values of voltage, current, temperature, and energy distribution during ramp and dump agree with those values calculated on the basis that the aluminum structure is solid, and are quite different from values calculated without considering shorting. On dump, the coil is partially self-protecting, but 23% of the initial stored energy is deposited in the structure at cryogenic temperature. The various effects of the shorting are apparently tolerable for testing in the International Fusion Superconducting Magnet Test Facility (IFSMTF).

10648 (CONF-860914—14) Preliminary results of the US pool-boiling coils from the IFSMTF full-array tests. Lue, J.W.; Dresner, L.; Lubell, M.S.; Luton, J.N.; McManamy, T.J.; Shen, S.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 6p. NTIS, PC A02. File Number DE87001830.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

The Large Coil Task to develop superconducting magnets for fusion reactors, is now in the midst of full-array tests in the International Fusion Superconducting Magnet Test Facility at Oak Ridge National Laboratory. Included in the test array are two pool-boiling coils designed and fabricated by US manufacturers, General Dynamics/Convair Division and General Electric/Union Carbide Corporation. So far, both coils have been energized to full design currents in the single-coil tests, and the General Dynamics coil has reached the design point in the first Standard-I full-array test. Both coils performed well in the charging experiments. Extensive heating tests and the heavy instrumentation of these coils have, however, revealed some generic limitations of large pool-boiling superconducting coils. Details of these results and their analyses are reported.

10649 (DOE/DP/40205—1) Two plasmon decay and SRS [stimulated Raman scattering] instabilities in a 0.35 μm laser irradiated plasmas: Final technical report for the period 6 November 1984-31 July 1986. Joshi, C.; Chen, F.F. (California Univ., Los Angeles (USA). Dept. of Electrical Engineering). Oct 1986. Contract AS08-85DP40205. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87003119.

Studies of stimulated Raman back and forward scattering and the generation of high energy electrons at 0.35 microns are presented. To isolate the various phenomena occurring at different densities, we attempted to control the plasma density by varying the thickness of the foil targets and also by using foam targets of variable average density. The frequency of the scattered light is used as a diagnostic to measure the plasma density. Time resolved and time integrated spectra for various plasma densities are discussed. Also, the measured energy and angular distribution of the high energy electrons from foil targets are presented. Two-plasmon decay is suggested as the probable mechanism generating the hot electrons. The backscattered light presents a broadband spectrum in the sub-half-harmonic region. This spectrum is limited by a sharp cut-off near 400 nm and by a spectral gap near the half-harmonic region. The half-harmonic spectrum is shown to be split into a red and a blue shifted peak. Effects of the self-generated magnetic fields and plasma temperature on Raman scattering and two-plasmon decay, respectively, are examined as possible mechanisms responsible for the splitting of the half-harmonic spectrum. Finally, a discussion of the effects of the coupling of Raman and Brillouin scattering on the Raman spectrum is presented with emphasis on the quarter critical region. This last mechanism is suggested to contribute to the splitting of the half-harmonic light.

10550 (DOE/DP/40207—1) **Measurements of parametric instability near the critical density and the resultant electron heating: Final report.** Mizuno, K.; De Groot, J.S.; Seka, W. (California Univ., Davis (USA). Dept. of Applied Science). 26 Aug 1986. Contract AS08-84DP40207. 21p. (PRG-R—128). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003120.

Detailed studies of the ion acoustic parametric decay instability have been made. Theoretical and particle simulation results indicate these instabilities are important in long scale length plasma irradiated by moderate intensity laser light ($10'' \leqq I\lambda^2$/T/sub e/ (W/cm^2) (μm^2)/(keV) $\leqq 5 \times 10^{14}$). Laser light ($\lambda_0 \simeq 1/2$ μm) is focused onto a CH target. The parametric decay instability has been measured by detecting the emission spectrum at frequencies near $2\omega_0$. The experimental results clearly indicate that this parametric instability is important for short wavelength (1/2 μm) laser light irradiation. The threshold of the parametric instability ($\lambda_0 = 1/2$ μm) was only slightly higher than that of 1 μm laser case. The measured wavelength shift of the Stokes component ($\lambda_0 = 1/2$ μm) compared very well with the 1 μm laser results.

10551 (DOE/ET/51013—195) **The Tara control, monitoring, data acquisition and analysis system.** Sullivan, J.D.; Gaudreau, M.P.J.; Blanter, B.; Fredian, T.W.; Irby, J.H.; Karcher, C.A.; Rameriz, R.; Sevillano, E.; Stillerman, J.; Thomas, P. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Sep 1986. Contract AC02-78ET51013. 10p. (PFC/CP—86-12; CONF-860917—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002770.

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

Experiments at the MIT Tara Tandem Mirror utilize an integrated system for control, monitoring, data acquisition, physics analysis, and archiving. This system consists of two distinct parts with narrowly defined information interchange; one to provide automated control and real time monitoring of engineering functions and one to acquire, analyze, and display data for physics in near real time. Typical machine operation achieves a total cycle time of 3 to 8 minutes with 5 to 7 Mbytes of data stored and with ~160 individual signals displayed in hardcopy on ~10 pages.

10552 (DOE/ET/51013—196) **The Tara 24 mva magnet system.** Gaudreau, M.P.J.; Shuster, M.S.; Berkman, V.J.; Thomas, P. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Sep 1986. Contract AC02-78ET51013. 12p. (PFC/CP—86-13; CONF-860917—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002771.

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

Power transmission, conversion, control, and regulation aspects of the Tara tandem mirror 24 mva magnet system are discussed in detail. The magnet coil set, magnetic field configuration and support vacuum chamber are described. It is shown that a complete turn key pulse magnet power system has been built for under $21/kW.

10553 (EGG-M—30686) **Inherent/passive safety in fusion power plants.** Piet, S.J.; Crocker, J.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 11p. (CONF-861143—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002605.

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

The concept of inherent or passive safety for fusion energy is explored, defined, and partially quantified. Four levels of safety assurance are defined, which range from true inherent safety to passive safety to protection via active engineered safeguard systems. Fusion has the clear potential for achieving inherent or passive safety, which should be an objective of fusion research and design. Proper material choice might lead to both inherent/passive safety and high mass power density, improving both safety and economics. When inherent or passive safety is accomplished, fusion will be well on the way to achieving its ultimate potential and to be a truly superior energy source for the future.

10554 (GA-A—18517) **Tokamak as an x-ray/XUV light source.** Lee, P. (GA Technologies, Inc., San Diego, CA (USA)). Jul 1986. Contract AC03-84ER51044. 8p. (CONF-860880—40). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002934.

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

Modern large tokamak devices, with electron and ion temperatures in the range of 1 to 10 keV, plasma densities of 1 to 10 x 10^{13} cm^{-3}, and quasistationary discharges of 1 to 10 s, emit copious amounts of soft x-ray and XUV radiation. Furthermore, plasma parameters such as temperatures, density, power input, and radiative power are usually well-characterized, making tokamak discharges extremely useful in experimental atomic physics and, to a lesser extent, instrumentation calibration.

10555 (GSI—86-13) **High energy density in matter produced by heavy ion beams. Annual report 1985.** (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). May 1986. 89p. NTIS (US Sales Only), PC A05/MF A01. File Number DE87750329.

In this report the activities of the GSI Darmstadt (FRG) during 1985 concerning inertial confinement fusion by heavy ion beams. Short communications and abstracts are presented concerning a Z-pinch experiment, heavy ion pumped lasers and X-ray spectroscopy, the study of ion-ion collisions, a RFQ development and beam transport studies, accelerator theory, targets for SIS/ESR experiments, the Rayleigh-Taylor instability, studies on the equation of state for matter under high pressure, as well as the development of computer codes. (HSI).

10556 (INDC(NDS)—179/G, pp 61-66) **Helium measurements for the U.S. fusion program.** Kneff, D.W.; Greenwood, L.R. (Rockwell International Corp., Canoga Park, CA, USA; Argonne National Lab., IL, USA). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

In the U.S. we have been engaged in a coordinated program to develop helium and radiometric dosimetry for the fusion materials program. This work is being performed primarily by Rockwell and Argonne. Helium and radiometric monitors have been combined in numerous experiments in all types of irradiation facilities including fission reactors, 14 MeV sources, and new high-energy accelerator neutron sources. The goal of this work is not only to measure helium production during specific irradiations, but also to test the helium production cross sections leading to improved helium predictions in materials irradiations. The helium measurements are performed by mass spectrometry at Rockwell using either prepared helium monitors or simple wires which have also been used for radiometric dosimetry. The latter technique is especially important when space is at a premium in reactor irradiations. For fission reactors, selected comparisons between measured and calculated helium production are shown. 9 refs, 4 tabs.

10557 (INIS-mf—10512, pp 56) **Fusion with a reduced tritium inventory.** Kernbichler, W.; Heindler, M.; Feldbacher, R. (Technische Univ., Graz, Austria. Inst. fuer Theoretische Physik und Reaktorphysik). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10558 (INIS-mf—10512, pp 27) **Muon catalyzed fusion in cold deuterium-tritium mixtures.** Breunlich, W.H.; Cargnelli, M.; Kammel, P.; Marton, J.; Naegele, N.; Pawlek, P.; Scrinzi, A.; Werner, J.; Zmeskal, J.; Bistirlich, J. (Oesterreichische Akademie der Wissenschaften, Vienna). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10559 (INIS-mf—10512, pp 85) **Measurement of decisive parameters in the muon-catalyzed fusion.** Breunlich, W.H.; Cargnelli, M.; Kammel, P.; Marton, J.; Naegele, N.; Pawlek, P.; Scrinzi, A.; Werner, J.; Zmeskal, J.; Bistirlich, J. (Oesterreichische Akademie der Wissenschaften, Vienna). 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700241. (CONF-8609176—).

From Austrian Physical Society annual convention; Innsbruck, Austria (22 Sep 1986).

10560 (INIS-SU—353, pp 55-58) **Plasma focus as a heavy ion source in the problem of heavy ion fusion.** Gribkov, V.A.; Dubrovskij, A.V.; Kalachev, N.V.; Krokhin, O.N.; Silin, P.V.; Nikulin, V.Ya.; Cheblukov, Yu.N. (AN SSSR, Moscow. Fizicheskij Inst.; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE87780034.

Kratkie Soobshcheniya po Fizike.; (No. 6).

In Experimental and theoretical physics. Collection.

Results of experiments on the ion flux formation in a plasma focus (PF) to develop a multicharged ion source for thermonuclear facility driver are presented. In plasma focus accelerating section copper ions were injected. Advantages of the suggested method of ion beam formation are demonstrated. Beam emittance equalling < 0.1 cmxmrad is obtained. Plasma focus ion energy exceeds 1 MeV. Plasma focus in combination with a neodymium laser is thought to be a perspective ion source for heavy ion fusion. 7 refs.

10561 (IPP—4/228) **Antenna optimization for Alfven wave heating.** Puri, S. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jun 1986. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87750327.

Antenna optimization studies for radio-frequency coupling to the Alfven waves is carried out using a self-consistent, three dimensional, fully-analytic, Faraday-shielded, periodic-loop-antenna model. The antenna characteristics (the loading resistance R, the reactance X, the quality factor Q, and the efficiency etasub(A)) are invesigated over a wide range of parameters using the ASDEX UPGRADE parameters as reference. With proper care it is possible to obtain an experimentally acceptable loading of Rproportional1 Ω with an attendant Qproportional20 under optimal conditions. The required conditions consist of (i) locating the singular Alfven layer at about two-thirds the plasma radius, and (ii) the adjacent antenna separation along the toroidal direction is of the order of the plasma radius. This implies using a toroidal wave number n proportional 8, for the ASDEX UPGRADE case. The extensive results presented here should facilitate the antenna design for Alfven-wave heating in most existing as well as projected machines. By scaling the linear dimensions of the ASDEX UPGRADE it is shown that the Alfven-wave heating continues to be an attractive alternative even for plasmas of thermonuclear dimensions. Due to the changing plasma conditions during the radio-frequency heating phase, dynamic impedance tracking may become necessary. Methods for maintaining an efficient coupling under these conditions through the phase control of a dense-cluster-array antenna, resembling the lower-hybrid grill coupler, is suggested.

10562 (IPPJ—725, pp 120-135) **Stability of implosion dynamics.** Takabe, H.; Hattori, F.; Mima, K. (Osaka Univ., Suita, Japan. Inst. of Laser Engineering). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The time development of the linear perturbation in spherically imploding plasma has been investigated with a model simulation for a glass shell target filled with the fuel. For a nonuniformity in applied ablution pressure, the displacement increases gradually in time in the acceleration phase predominantly in the radial direction. However, an instability drives an explosive growth of the displacement in the stagnation phase. The result by the stability analysis with self-similar solution modeling the stagnation dynamics agrees with the simulation result; the explosive increase of the displacement is due to the Rayleigh-Taylor instability in a dynamical system. As the results of the numerical and analytic investigations, the possibility of the fuel-pusher mixing, which degrades the ignition and burning process in the fuel, is pointed out.

10563 **(IPPJ—725) Workshop report on 'simulation techniques for shock wave phenomena' and 'characteristics of plasmas in inertial confinement fusion'.** (Nagoya Univ. (Japan). Inst. of Plasma Physics; Osaka Univ., Suita (Japan). Inst. of Laser Engineering). Mar 1985. 231p. (CONF-8411277—). NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044.

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

Separate abstracts were prepared for each of the included papers. (MOW)

10564 **(Juel—2058) Determination of effective cross sections and production rates for tritium in the irradiation experiment TRIDEX.** Weise, L. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie). Apr 1986. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750330.

In the framework of the development of a fusion reactor blanket the irradiation experiment TRIDEX (Tritium Recovery Irradiation DIDO Experiment) takes place at the Juelich Research Reactor FRJ-2 (DIDO). For this equipment the required neutronic calculations have been performed. The aim was the determination of the neutron spectrum and several therefrom derived integral parameters for the irradiation positions in interest. From the calculated effective cross sections for the formation of Tritium resulting from irradiated Lithium samples on one hand and from measured neutron flux densities on the other hand, all needed quantities of the Tritium production could be determined. The calculation of the neutron spectrum has been performed in a two-dimensional x-y-geometry. The neutron flux densities have been gained by gamma-spectrometric measurement of the activities in irradiated activation samples.

10565 **(KMSF-U—1754) Cryogenic ICF target technology at the Omega facility, University of Rochester.** Musinski, D.L.; Ankney, J.S.; Decker, D.N.; Felmlee, W.J.; Frazier, R.E.; Groves, W.A.; Mruzek, M.T. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1986. Contract AC08-82DP40152. 18p. (CONF-861019—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002822.

From 10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society; Baltimore, MD, USA (27 Oct 1986).

To take full advantage of the capabilities offered by the Omega laser facility, the experimental teams at the University of Rochester need the capability to field cryogenic targets. The cryogenic target delivery system must be able to produce uniform solid or liquid DT layers 2 to 20 μm within polymer shells which are 300 to 400 μm in diameter. The facility must be able to maintain its experiment rate of one shot per half-hour and each target must be documented within the experimental chamber for post shot analysis. We will discuss the approach and equipment that KMS is using in collaboration with the University of Rochester to provide Omega with the capability to field cryogenic ICF targets.

10566 (KURRI-TR—249, pp 65-72) **Cryogenic irradiation experiment of superconductors with 14 MeV neutrons from RTNS-II.** Okada, Toichi. (Osaka Univ., Suita, Japan. Inst. of Scientific and Industrial Research). 1984. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE87780042. (CONF-8311298—).

From Meeting at KURRI on design of the facility for high flux and low temperature irradiations; Kumatori, Osaka, Japan (2 Nov 1983).

In order to realize nuclear fusion reactors by the containment method with magnetic field, superconducting magnets are indispensable in view of the energy balance. Superconducting magnets have two features from the viewpoint of nuclear fusion reactor technology. They are the compound structure, of which the composing elements are superconducting material, stabilizing material, electric insulator, heat insulator, structural material and cryogen. Their performance is affected by the spatial relation of these six elements. Superconducting magnets are the electric equipment which generates magnetic field by passing current through coils. This study is the material test aiming at clarifying the neutron spectrum dependence of irradiation damage, the temperature dependence of neutron irradiation effect and the usability of RTNS-2 for these experiment. The new superconducting Nb_3Sn wires were irradiated with 14 MeV neutrons at 4.2 K, and the critical current density was successfully measured in the magnetic field up to 12 T. The neutron flux was up to 1.75×10^{18} n/cm^2. The experimental method and the results are reported. The tendency was different between in-situ samples and monofilament samples.

10567 (LA-UR—86-3813) **Theory of the evolution of the decaying spheromak.** Sgro, A.G.; Marklin, G.; Mirin, A.A. (Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-861191—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002913.

From Compact toroid workshop; Osaka, Japan (21 Nov 1986).

The strongly nonlinear dynamics present in decaying Spheromaks has been studied by various computational methods, demonstrating the tendency of the plasma to oscillate about or approach relaxed states and resulting in new insight into the significance of minimum energy states.

10568 (LA-UR—86-3875) **Unanswered questions from CTX.** Wright, B.L.; Barnes, C.W.; Fernandez, J.C.; Henins, I.; Hoida, H.W.; Jarboe, T.R.; Knox, S.O.; Marklin, G.J.; Platts, D.A. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-861191—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002903.

From Compact toroid workshop; Osaka, Japan (21 Nov 1986).

The big question being addressed on CTX during the past year has been: Why was energy confinement not improved by increasing the mesh flux conserver radius from 40 cm to 67 cm? A comparison of decaying spheromaks with the same values of j and n in the two cases shows tau/sub B/2 improving roughly as R^2 but little change in T/sub e/. As a result, $<\beta>$/sub vol/ has gone from ~ 7.0% to ~ 2.0% and the inferred energy confinement time has remained unchanged at ~ 23 μs. An energy balance analysis of the 40 cm case showed that the observed rapid particle loss could account for most of the energy loss while providing a mechanism for the removal of impurities. At 67 cm, tau/sub p/ has also improved by about a factor of 2, particle loss therefore contributes substantially less to energy balance and the achievement in CTX of j/n/sub e/ as high as 3×10^{-14} A.m (I/sub tor/ up to 1 MA), low-Z impurities should not be a problem. A question then arises: Is CTX faced with a new strong energy loss mechanism that is characteristic of spheromaks in general? This question is not simply answered because it may involve processes of thermal conduction or convection that cannot be directly measured. In the following paragraphs we discuss many of the topics that have been considered in this search.

10569 (LRP—236/84) **Optimization of antennae for Alfven wave heating in the TCA tokamak.** Hofmann, F.; Appert, K.; Villard, L. (Ecole Polytechnique Federale, Lausanne (Switzerland)). May 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87900197.

A one-dimensioanl cylindrical model including Hall current effects is used to optimize the antenna system for Alfven wave heating in the TCA tokamak. The power absorbed in the plasma is computed as a function of the shape of the antenna, its orientation with respect to the poloidal magnetic field, its radial position as well as its fundamental toroidal wave number. The study reveals several ways of improving the performance of the modular antenna system used in TCA.

10570 (LRP—247/84) **Open resonator for quasi-optical gyrotrons: Structure of the modes and their influence.** Perrenoud, A.; Tran, T.M.; Tran, M.Q.; Rieder, C.; Schleipen, M.; Bondeson, A. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland); Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics). Jul 1984. 42p. (CONF-8407120—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900206.

From International symposium on gyrotron development; Lausanne, Switzerland (4 Jul 1984).

The influence of the resonator geometry on the design of quasi-optical gyrotrons is presented. Basic equations and relevant properties of quasi-optical resonators are reviewed. Since confocal resonators radiate an equal amount of power from each mirror, non-confocal resonators have to be used in order to maximize the output-coupling on one side. Technical constraints on ohmic power losses and mirror diameter are discussed. Using numerical solutions of the quasi-optical resonator equations, the influence of the actual electromagnetic field profile on the electronic efficiency is calculated for several cases.

10571 (LRP—277/85) **Design of a quasi-optical 120 GHz gyrotron.** Mathews, H.G. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland); Brown, Boveri und Co. Ltd., Baden (Switzerland)). Sep 1985. 14p. (CONF-8509192—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900187.

From Course and workshop on applications of RF waves to tokamak devices; Varenna, Italy (5 Sep 1985).

In recent years, various countries have started gyrotron development programs aimed towards high power (>200 kW) and continuous operation in the frequency range 100 to 150 GHz. One application of these millimeter wave sources is the electron cyclotron resonant heating of plasmas in the present and next generation of fusion machines. As a first stage of a development program aimed towards a 150 GHz high power gyrotron, the Switzerland-Euratom Association has undertaken the construction of a 120 GHz quasi-optical gyrotron at a power level of 200 kW. This paper will describe the technical development performed by BBC in the frame of the project.

10572 (NP—7900240) **Laboratory of reactor physics: Triennial research report, 1981-1983.** Green, L.; Haldi, P.A.; Ligou, J.; Schneeberger, J.P. (Ecole Polytechnique Federale, Lausanne (Switzerland). Dept. de Physique). Feb 1984. 110p. NTIS (US Sales Only), PC A06/MF A01. File Number DE87900240.

This report describes our research activities in fusion blanket neutronics and ion beam fusion for the period 1981-1983. During this period the LOTUS project has been realized, so that we are now in a position to perform experiments on blanket concepts related both to fusion-fission hybrids or pure fusion systems. In the second domain, work focused on numerical simulations using the codes CIRCE/MEDUSA.

10573 (NRL-MR—5892) Variation in the amplitude of perturbations on the inner surface of an imploding shell during the coasting phase: Interim report, September 1985-June 1986. Book, D.L.; Bodner, S.E. (Naval Research Lab., Washington, DC (USA)). 10 Nov 1986. Contract AI08-79DP40092. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003663.

In some inertial confinement fusion target designs a spherical shell collapses on a void or compresses a small amount of gaseous material. There can be a period during which both the outside (driver) pressure and the inside pressure have a negligible effect on the implosion dynamics, and the motion is essentially ballistic. The changes in the aspect ratio occur mainly because of geometrical convergence. For reasonable parameters the inner surface does not begin to decelerate until shortly before convergence is complete. We have developed an approximate description of this "coating" phase and applied it to study the evolution of perturbations on the inner and outer surfaces of the shell in the limit where the fluid is incompressible. The two surfaces are strongly coupled as long as the shell remains thin. When the shell becomes thick compared to the inner radius, the inner and outer surface perturbations decouple. Under these conditions the surface wave action is a good adiabatic invariant, which can be used to estimate the change in the amplitude of a perturbation as a function of the shell inner radius R_1. Detailed analysis confirms the adiabatic invariance argument and extends the results. We speculate that the adiabatic invariant may also be good in the case of compressible fluids.

10574 (PPPL—2365) Designs for a TFTR full-power pumped limiter. Budny, R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003073.

A pumped-limiter system which would provide increased particle control and enhance the performance of full-power discharges is being considered for TFTR. The system consists of two toroidal belts located near the Zirconium-Aluminium (ZrAl) getter panels. The limiter blades would be made of carbon/carbon composite in order to have a very thin profile, allowing a large fraction of the scrape-off flux to be pumped. Simulations of the plasma scrape-off and neutral transport indicate that the limiter pumping should reduce the recycling coefficient by 10 to 25%. Simulations of central plasma processes indicate that the lowered recycling could increase Q/sub fusion/ by more than 100%. This paper discusses the designs and the performance predictions for the system.

10575 (PPPL—2378) Long- and short-term trends in vessel conditioning of TFTR [Tokamak Fusion Test Reactor]. LaMarche, P.H.; Dylla, H.F.; Bell, M.G.; Boody, F.P.; Bush, C.E.; Groebuer, R.J.; Hawryluk, R.J.; Hill, K.W.; Mueller, D.; Owens, D.K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003067.

We have investigated trends in the conditioning of the Tokamak Fusion Test Reactor (TFTR) vacuum vessel during the May 1984 to April 1985 run period. The initial conditioning of the vessel, consisting of glow discharge cleaning (GDC) and pulse discharge cleaning (PDC) in concert with a 150°C vessel bakeout, is necessary to assure plasma operation after atmospheric venting. A long-term conditioning process, ascribed to limiter conditioning, effectively improves operational conditions during the course of the run. Over several thousand high power plasma discharges, the improvement was documented by using standard parameter (fiducial) plasma discharges. Several techniques demonstrated short-term improvements in vessel conditioning during this time period, including: Cr gettering and programming the plasma position relative to the limiter contact area.

10576 (PPPL—2383) An algorithm for the analysis of inductive antennas of arbitrary cross-section for heating in the ion cyclotron range of frequencies. Lehrman, I.S.; Colestock, P.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003079.

The application of Ion Cyclotron Range of Frequency (ICRF) heating to near ignited plasmas will require launching structures that will be capable of withstanding the harsh plasma environment. The recessed antenna configuration is expected to provide sufficient protection for the structure, but to date no analysis has been done to determine if adequate coupling can be achieved in such a configuration. In this work we present a method for determining the current distribution for the antenna in the direction transverse to current flow and predict antenna loading in the presence of plasma. Antennas of arbitrary cross section are analyzed above ground planes of arbitrary shape. Results from ANDES, the ANtenna DESign code, are presented and compared to experimental results.

10577 (PPPL—2386) Plasma-material interactions in TFTR. Dylla, H.F.; Bell, M.G.; Blanchard, W.R.; Boody, F.P.; Bretz, N.; Budny, R.; Bush, C.E.; Cecchi, J.L.; Cohen, S.A.; Combs, S.K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003065.

This paper presents a summary of plasma-material interactions which influence the operation of TFTR with high current ($\leqq$ 2 MA), ohmically heated and high power (~ 10 MW), neutral-beam-heated plasmas. The conditioning procedures which are applied routinely to the first-wall hardware are reviewed. Fueling characteristics during gas, pellet, and neutral beam fueling are described. Recycling coefficients near unity are observed for most gas-fueled discharges. Gas-fueled discharges after helium discharge conditioning of the toroidal bumper limiter and discharges fueled by neutral beams and pellets show $R < 1$. In the vicinity of the gas-fueled density limit (at n/sub e/ = 5 to 6 x 10^{+19} m^{-3}) values of $\leqq$ 1.5. Increases in Z/eff of $\leqq$ 1 have been observed with neutral beam heating of 10 MW. The primary low-Z impurity is carbon with concentrations decreasing from ~10% to <1% with increasing n/sub e/. Oxygen densities tend to increase with n/sub e/, and at the ohmic plasma density limit oxygen and carbon concentrations are comparable. Chromium getter experiments and He^{++}/D^{+} plasma comparisons indicate that the limiter is the primary source of carbon and that the vessel wall is a significant source of the oxygen impurity. Metallic impurities, consisting of the vacuum vessel metals (Ni, Fe, Cr), have significant (~ 10^{-4} n/sub e/) concentrations only at low plasma densities (n/sub e/ < 10^{+19} m^{-3}). The primary source of metallic impurities is most likely ion sputtering from metals deposited on the carbon limiter surface.

10578 (PPPL—2390) Experimental results from the TFTR tokamak. Hawryluk, R.J.; Arunasalam, V.; Bell, J.D.; Bell, M.G.; Bitter, M.; Blanchard, W.R.; Bloody, F.; Bretz, N.; Budny, R.; Bush, C.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1986. Contract AC02-76CH03073. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003074.

Recent experiments on TFTR have extended the operating regime of TFTR in both ohmic- and neutral-beam-heated discharges. The TFTR tokamak has reached its original machine design specifications (I/sub p/ = 2.5 MA and B/sub T/ = 5.2 T). Initial neutral-beam-heating experiments used up to 6.3 MW of deuterium beams. With the recent installation of two additional beamlines, the power has been increased up to 11 MW. A deuterium pellet injector was used to increase the central density to 2.5 x 10^{20} m^{-3} in high current discharges. At the opposite extreme, by operating at low plasma current (I/sub p/ ~ 0.8 MA) and low density (anti n/sub e/ ~ 1 x 10^{19} m^{-3}), high ion temperatures (9 +- 2 keV) and rotation speeds (7 x 10^{5} m/s) have been achieved during injection. In addition, plasma compression experiments have demonstrated acceleration of beam ions from 82 keV to 150 keV, in accord with expectations. The wide operating range of TFTR, together with an extensive set of diagnostics and a flexible control system, has facilitated transport and scaling studies of both ohmic- and neutral-beam-heated discharges. The results of these confinement studies are presented.

10579 (PPPL—2397) **Application of small-signal fusion energy gain.** Jassby, D.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1986. Contract AC02-76CH03073. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003072.

The measured burnup fraction of the 1-MeV tritons produced in a deuterium tokamak plasma, multiplied by 17.5, is essentially the small-signal fusion energy gain g/sub T/ for an ideal 1-MeV triton beam injected into the deuterium plasma. The measured g/sub T/ can be converted directly into the two-component fusion energy gain that would be realized if a lower energy tritium beam were injected into the plasma, or if a deuterium beam were injected into a tritium target plasma having the same parameters as the acutal deuterium plasma. Under certain conditions, g/sub T/ ≧ 1 can be obtained by injection of a low-current 225-keV tritium beam into a hot deuterium plasma, thereby verifying that the plasma has the essential characteristics needed for achieving macroscopic fusion energy "break-even."

10580 (SAND—86-8243) **Performance and metallography of a uranium tritide bed operated at elevated temperatures and tritium pressures.** Mote, M.W. Jr.; Mintz, J.M. (Sandia National Labs., Livermore, CA (USA)). Dec 1986. Contract AC04-76DP00789. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003590.

A uranium gettering bed was cycled between room temperature/zero pressure and 600C/275 psi (D_2) for 210 cycles over a period of 8 months. Metallographic examination of the hardware revealed an acceptable amount of reaction between the uranium and the stainless steel container. This exposure is estimated to represent about ten years of normal use.

10581 (UCID—20578) **Simple target models for ion beam fusion systems studies.** Bangerter, R.O.; Mark, J.W.K.; Magelssen, G. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). 30 Oct 1985. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003605.

Some of the target information required for reactor and systems studies is not readily available. In this paper we attempt to improve this situation by developing simple target models that give estimates of DT fuel mass, the masses of other target constituents, the DT burn fraction, and the fraction of energy in neutrons.

10582 (UCLA-ENG—86-38) **TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.** Conn, R.W.; Ghoniem, N.M.; Firestone, M.A. (eds.). (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). Sep 1986. Contract AS03-80ER52061. 415p. (UCLA/PPG—1009). NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE87002996.

Reactor system operation and procedures have a profound impact on the conception and design of power plants. These issues are studied here using a model tokamak system employing a solid-breeder blanket. The model blanket is one which has evolved from the STARFIRE and BCSS studies. The reactor parameters are similar to those characterizing near-term fusion engineering reactors such as INTOR or NET (Next European Tokamak). Plasma startup, burn analysis, and methods for operation at various levels of output power are studied. A critical, and complicating, element is found to be the self-consistent electromagnetic response of the system, including the presence of the blanket and the resulting forces and loadings. Fractional power operation, and the strategy for burn control, is found to vary depending on the scaling law for energy confinement, and an extensive study is reported. Full-power reactor operation is at a neutron wall loading pf 5 MW/m^2 and a surface heat flux of 1 MW/m^2. The blanket is a pressurized steel module with bare beryllium rods and low-activation HT-9-(9-C-) clad $LiAlO_2$ rods. The helium coolant pressure is 5 MPa, entering the module at 297°C and exiting at 550°C. The system power output is rated at 1000 MW(e). In this report, we present our findings on various operational scenarios and their impact on system design. We first start with the salient aspects of operational physics. Time-dependent analyses of the blanket and balance of plant are then presented. Separate abstracts are included for each chapter.

10583 (UCRL—94346) **Symmetry issues in a class of ion beam targets using short direct drive pulses.** Mark, J.W.K.; Lindl, J.D. (Lawrence Livermore National Lab., CA (USA)). 27 May 1986. Contract W-7405-ENG-48. 6p. (CONF-860510—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003159.

From Symposium on heavy ion inertial fusion; Washington, DC, USA (27 May 1986).

We address a class of modified ion beam targets where the symmetry issues are ameliorated in the regime of short bursts of direct drive pulses. Short pulses are here defined so that the fractional change in target radii of peak beam energy deposition are assumed to be small (during each such direct drive burst with a fixed beam focal radius). This requirement is actually not stringent on the temporal pulse-length. In fact we show an explicit example where this can be satisfied by a ≧ 60 ns direct drive pulse-train. A new beam placement scheme is used which systematically eliminated low order spherical harmonic asymmetries. The residual asymmetries of such pulses are studied with both simple model and numerical simulations.

10584 (UCRL—94784) **Inertial confinement fusion diagnostics.** Coleman, L.W. (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 27p. (CONF-860902—3). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002759.

From Course and workshop on basic and advanced fusion plasma diagnostic techniques; Varenna, Italy (3 Sep 1986).

The concept and goals of ICF will be briefly reviewed and the new 100 kJ class Nova laser facility will be described. Experimental results obtained to date with Nova will be summarized, and the discussions of diagnostics will use examples on the present capabilities of Nova and new developments that are underway. The classes of diagnostic systems to be discussed fall into three basic categories: optical, x-ray, and particle. Examples of highly space resolved, time resolved, and spectrally resolved techniques as well as schemes involving combinations of these capabilities will be presented. A brief summary of the sophisticated acquisition and analysis system in use for Nova data will be provided.

10585 (UCRL—95435) **MFTF-B acceptance tests and operation.** Coensgen, F.H.; Gerich, J.W.; Holl, P.M.; Karpenko, V.P.; Kozman, T.A.; Krause, K.H.; Labiak, W.C.; Lang, D.D.; Lathrop, G.H.; Lindquist, W.B. (Lawrence Livermore National Lab., CA (USA); TRW, Inc., Redondo Beach, CA (USA)). 24 Sep 1986. Contract W-7405-ENG-48. 11p. (CONF-861106—14; IAEA-CN—47/H-III-2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003395.

From IAEA international conference on plasma physics and controlled nuclear fusion research; Kyoto, Japan (12 Nov 1986).

Final acceptance tests of the Mirror Fusion Test Facility (MFTF-B) were completed in February 1986. These tests verified performance of the following subsystems: the magnet system, the vacuum system and vessel, cryogenic systems, 80-keV neutral-beam sources and power supplies, microwave power systems for plasma heating, the supervisory control and diagnostic system, and the local control and instrumentation system. The entire magnet system was operated at full field continuously for 24 hours. The largest field alignment error under full load, determined using an electron beam technique, was 6 mm, well within the required precision of 15 mm. Absolute values of the magnetic field were determined using nuclear magnetic resonance techniques and were found to be within 2% of predicted values. All magnetic protection systems and fault protection systems were tested at full load. At 4.35 K, the cooling capacity of the liquid helium system exceeded the 11 kW rating and the nitrogen reliquifier met its 500 kW rating.

10586 (UCRL—95478) **Statistical mechanics of hot dense matter.** More, R. (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 27p. (CONF-8509343—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87000500.

From La Jolla physics symposium; San Diego, CA, USA (6 Sep 1985).

Research on properties of hot dense matter produced with high intensity laser radiation is described in a brief informal review.

10587 (UCRL—95567-Rev.1) TMX-U [Tandem Mirror Experiment-Upgrade] tandem-mirror thermal-barrier experiments. Simonen, T.C.; Allen, S.L.; Baldwin, D.E.; Barter, J.D.; Berzins, L.V.; Carter, M.R.; Casper, T.A.; Clauser, J.F.; Coensgen, F.H.; Correll, D.L. (Lawrence Livermore National Lab., CA (USA); TRW, Inc., Redondo Beach, CA (USA); California Univ., Davis (USA); Sandia National Labs., Livermore, CA (USA); Maryland Univ., College Park (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki). 29 Oct 1986. Contract W-7405-ENG-48. 26p. (CONF-861106—11-Rev.1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002380.

From IAEA international conference on plasma physics and controlled nuclear fusion research; Kyoto, Japan (12 Nov 1986).

Thermal-barrier experiments have been carried out in the Tandem Mirror Experiment-Upgrade (TMX-U). Measurements of nonambipolar and ambipolar radial transport show that these transport processes, as well as end losses, can be controlled at modest densities and durations. Central-cell heating methods using ion-cyclotron heating (ICH) and neutral-beam injection have been demonstrated. Potential mesurements with recently developed methods indicate that deep thermal barriers can be established.

10588 (UCRL—95575) Computer simulations of particle-surface dynamics. Karo, A.M.; Hiskes, J.R.; DeBoni, T.M. (Lawrence Livermore National Lab., CA (USA); Texas Univ., Austin (USA)). Oct 1986. Contract W-7405-ENG-48. 11p. (CONF-8610115—3). NTIS, PC AQ 02/MF A01; 1; GPO Dep. File Number DE87002557.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

Our simulations of particle-surface dynamics use the molecular dynamics codes that we have developed over the past several years. The initial state of a molecule and the parameters defining the incoming trajectory can be specifically described or randomly selected. Statistical analyses of the states of the particles and their trajectories following wall collisions are carried out by the code. We have carried out calculations at high center-of-mass energies and low incidence angles and have examined the survival fraction of molecules and the dependence upon the incoming trajectory. We report also on preliminary efforts that are being made to simulate sputtering and recombinant desorption processes, since the recombinant desorption of hydrogen from typical wall materials may be an important source for vibrationally-excited hydrogen in volume sources; for surface sources the presence of occluded hydrogen may affect the concentration of atomic species.

10589 Divertor engineering international Tokamak reactor. Mattas, R.F.; Baskes, M.I.; Brooks, J.N.; Blanchard, J.P.; Hassanein, A.M.; Tobin, A. (Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL 60439). *Fusion Technology;* **10**: No. 3, 364-381(Nov 1986).

Recent plasma physics experiments and calculations indicate that the divertor is likely to operate with presheath plasma temperatures of only 10 to 20 eV. Surface sputtering erosion should be virtually eliminated under these conditions resulting in extended sputtering lifetimes for the divertor collector plates. The reduced sputtering means that the collector plates can be designed with only a thin layer of protection material facing the plasma, which should lead to reduced thermal stresses, greater heat load capability, and longer lifetimes. To assess the advantages and disadvantages of this type of divertor system, engineering trade-off studies have been performed. The studies include analyses of the materials, fabrication, thermomechanical behaviour, disruptions, erosion/redeposition, tritium permeation, and lifetime. It is concluded that the divertor collector plates, which are composed of a copper alloy heat sink with a tungsten cladding, should operate satisfactorily for a period ≧ 2 yr.

10590 Neutronic data-base assessment for U.S. INTOR. Jung, J.C.; Youssef, M.Z.; Cheng, E.T.; Lee, J.D. (Argonne National Lab., 6700 S. Cass Avenue, Argonne, IL). *Fusion Technology;* **10**: No. 3, 382-395(Nov 1986).

A data-base assessment of neutronics and tritium breeding for the International Tokamak Reactor (INTOR) is presented. This work is based on a recent study conducted for the U.S. contributions to the Phase IIA INTOR study. The data-base assessment is divided into three areas: tritium breeding requirement, nuclear data, and neutronics methods and codes.

10591 Neutron Dosimetry Tokamak Fusion Test Reactor Lithium Blanket Module. Tsang, F.Y.; Harker, Y.D.; Anderl, R.A.; Nigg, D.W.; Jassby, D.L. (EG&G Idaho, Inc., Idaho National Engineering Lab., Fusion Technology Program, P.O. Box 1625, Idaho Falls, ID). *Fusion Technology;* **10**: No. 3, 396-404(Nov 1986).

The Tokamak Fusion Test Reactor (TFTR) Lithium Blanket Module (LBM) program is a first-of-kind neutronics experiment involving a toroidal fusion neutron source. Qualification experiments have been conducted to develop primary measurement techniques and verify dosimetry materials that will be used to characterize the neutron environment inside and on the surfaces of the LBM. The deuterium-tritium simulation experiments utilizing a 14-MeV neutron generator and a fusion blanket mockup facility at the Idaho National Engineering Laboratory are described. Results and discussions are presented that identify the quality and limitations of the measured integral reaction data, including the minimum fluence requirement for the TFTR experiment.

10592 Fusion of low atomic number, wall coating materials in high-temperature plasmas. Gilligan, J.G.; Stroud, P.D. (North Carolina State Univ., Dept. of Nuclear Engineering, Box 7909, Raleigh, NC). *Fusion Technology;* **10**: No. 3, 440-447(Nov 1986).

The fusion of common wall coating materials is considered in high-temperature plasmas. The concept is attractive since the detrimental effects of these materials as primary impurities are diminished. It is determined that fusion power densities can be increased by including the impurity reactions for a specified impurity content; however, this increase is more than offset by the corresponding decrease in power density due to primary fuel depletion. It is noted that impurity fusion reactions should be included in fuel cycle analyses since ash isotopes may impact the vacuum pumping technology of the reactor.

10593 Experimental observations of the coupling between induced currents and mechanical motion in torsionally supported square loops and plates. Bialek, J.M.; Cargulia, G.J.; Ulrickson, M.; Knott, M.J.; Turner, L.R.; Wehrle, R.B. (Plasma Physics Lab., Princeton Univ., P.O. Box 451, Princeton, NJ). *Fusion Technology;* **10**: No. 3, 448-461(Nov 1986).

A series of experiments that were successfully conducted to investigate the coupling between induced currents and rigid body rotation in square loops and plates is presented. The experimental arrangement consisted of a conducting test piece, rigidly mounted in a nonconducting fixture that provided a controlled stiffness against rotation. Electric current were induced in the test loop/plate by pulsing a magnetic field oriented perpendicular to the test piece. This was done in the presence of a constant magnetic field oriented parallel to the loop/plate. The interaction of the induced currents and the background magnetic field produced a net torque about the axis of the test fixture. Measurements were made of the total current flowing around the test piece and the angular rotation versus time. The observed data exhibited the magnetic damping and magnetic stiffness effects that arise in coupled systems and agreed very well with the predicted responses for both the loops and plates.

10594 Tokamak fusion test reactor FELIX plate experiment. Hua, T.O.; Nygren, R.E.; Turner, L.R. (Argonne National Lab., Fusion Power Program, Bldg. 205, 9700 S. Cass Avenue, Argonne, IL). *Fusion Technology;* **10**: No. 3, 411-423(Nov 1986).

For a conducting material exposed to both a time-varying and a static magnetic field, such as a limiter blade in a tokamak, the induced eddy currents and the deflection arising from those eddy currents can be strongly coupled. The coupling effects reduce the currents and deflections markedly, sometimes an order of magnitude, from the values predicted if coupling is neglected. A series of experiments to study current-deflection coupling were performed using the Fusion Electromagnetic Inductance Experiment (FELIX) facility at Argonne National Laboratory. Magnetic damping and magnetic stiffness resulting from the coupling are discussed, and analytical expressions for induced eddy current and rigid body rotation in the FELIX plate experiment are compared with the experimental results. Predictions for the degree of coupling based on various parameters are made using the analytical model.

10595 **Industry and Utility perspectives on Future directions in Fusion energy development.** Bolta, C.C.; Drew, H.; Kolb, A.C.; Landis, J.W.; Matson, K.L.; Rose, P.H.; Scott, F.R.; Staudhammer, P.; Walker, S.E. (Combustion Engineering, San Diego, CA). *Journal of Fusion Energy;* 5: No. 2, 135-154(Jun 1986). (CONF-850157—).

From Fusion Power Associates symposium on the search for attractive fusion concepts; La Jolla, CA, USA (31 Jan 1985).

The authors discuss such topics as some of the technical areas in which industry has strengths that could be applied to fusion problems, the opportunities in the fusion field that have been offered to industry, and some of the important factors that might be looked for when attempting to join a joint venture. Conceptual design and economic studies are examined for the fusion program. Two alternate energy technologies are discussed, geothermal wellhead power and the wind machine. Funding for fusion is discussed. Perceptions of what should be included in the future program of fusion in order to successfully develop this technology into a source of energy are discussed. The development of OHTE, a compact, high-power density approach to fusion, by Phillips Petroleum and GA technologies, is examined.

10596 **Prospects for alternative Fusion Fuels.** Glancy, J. (Science Applications Intl. Corp., Lajolla, CA). *Journal of Fusion Energy;* 5: No. 2, 155-157(Jun 1986). (CONF-850157—).

From Fusion Power Associates symposium on the search for attractive fusion concepts; La Jolla, CA, USA (31 Jan 1985).

The author has worked on three different magnetic confinement concepts for alternate fusion fueled reactors: tokamaks; tanden mirrors, and reversed field pinches. The focus of this article is on prospects for alternate fusion fuels as the author sees them relative to the other choices: increased numbers of coal plants, fission reactors, renewables, and D-T fusion. Discussion is limited on the consideration of alternate fusion fuels to the catalyzed deuterium-deuterium fuel cycle. Reasons for seeking an alternate energy source are cost, a more secure fuel supply, environmental impact and safety. The technical risks associated with development of fusion are examined briefly.

10597 **Prospects for developing attractive inertial fusion concepts.** Cornwall, T.; Bodner, S.; Herrmannsfeldt, W.B.; Hogan, W.; Storm, E.; VanDevender, J.P. (USDOE, Washington, DC). *Journal of Fusion Energy;* 5: No. 2, 125-134(Jun 1986). (CONF-850157—).

From Fusion Power Associates symposium on the search for attractive fusion concepts; La Jolla, CA, USA (31 Jan 1985).

The authors discuss the role of inertial fusion in relationship to defense activities as well as in relation to energy alternatives. Other general advantages to inertial fusion besides maintaining the system more cheaply and easily, are discussed such as certain designs and the use of very short wavelength with a very modest laser intensity. A discussion on the direct illumination approach is offered. The progress made in high-gain target physics and the potential for development of solid-state lasers as a potential multimegajoule driver and a potential high-rep-rate fusion driver are discussed. Designs for reaction chambers are examined, as is the heavy-ion fusion program. Light-ion accelerators are also discussed.

10598 **Fusion neutral-particle beam research and its contribution to SDI programs.** Haselton, H.H. (Oak Ridge Natl. Lab., Oak Ridge, TN). *Journal of Fusion Energy;* 5: No. 1, 77-84(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

The fusion program has developed a number of technologies with application to components of the SDI. The author focuses on the neutralparticle beam issues, with some discussion of other development areas and technologies that can be brought to bear on SDI. The long-pulse, positive-ion sources developed for fusion plasma heating have parameters as shown in this article. In the development of neutral-particle beams and rf heating technology, the author discusses a beam injection system and the state of the art in the negative-ion development program. Other aspects of plasma technology relating to SDI that are mentioned are plasma fueling, plasma edge technology, magnet development, and neutronics and diagnostics.

10599 **Induction LINACS and Free electron laser amplifiers.** Briggs, R.J. (L.Livermore Natl. Lab., Livermore, CA). *Journal of Fusion Energy;* 5: 85-95(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

The author discusses the connections between activities in fusion research and directed energy weapons. The author examines the early stages of the controlled fusion program at Livermore, back in the early 1970s, with a machine called Astron accelerator. The Advanced Test Accelerator (ATA) is also discussed, as is a later technique called laser guiding, that involves a small-diameter KrF laser beam shooting through the entire accelerator and beyond. The author also addresses the subject of free electron lasers (FEL) and follows the development of the thought process that went into it. The author states that theoretical studies of FEL amplifiers indicate that with the right electron beam current and brightness, 30-40% conversion of beam energy into laser light is possible in a single pass.

10600 **KrF lasers for fusion: Issues and promises.** Center, R.E. (Spectra Technology, Bellevue, WA). *Journal of Fusion Energy;* 5: No. 1, 51-56(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

According to the author, renewed interest in KrF lasers as drivers for the ICF program is derived from recent development in KrF laser technology, including improved wall plug efficiency, reduced system complexity for megajoule drivers, and competitive cost levels. In this paper, a review of the KrF laser technology in the late 1970s is presented. This review is followed by a description of the new developments that give reason for hope that these systems might become developed at fairly reasonable cost and size for the fusion application. The KrF laser is a class of rare-gas halide excimer laser. The projected efficiency limits of electron-beam-pumped KrF lasers are shown as of the late 1970s. The potential efficiency of both electronbeam and sustained-discharge KrF lasers, including recent developments, is shown.

10601 **Pulsed power, ICF, and SDI.** Van Devender, J.P. (Sandia Natl, Labs., Albuguergue, NM). *Journal of Fusion Energy;* 5: No. 1, 33-40(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

Pulsed power technology has been developed over many years for nuclear weapon effects simulation, inertial fusion, and directed energy. Every four years there is a factor of ten increase in power available, and we are now near the 100 TW, couple of million joule (MJ) mark, according to the author. 100 TW is sufficient for studying physics relevant to Inertial Confinement Fusion (ICF) or the Strategic Defense Initiative (SDI). Pulsed power can be viewed as a basic technology for making electron beams, X-rays, and ion beams. Applications include ICF, plasmoid-directed energy weapons, and microwave weapons. The author presents a set of tentative requirements for an effective defense, a concept for deploying the defense, and a strategy for making the transition to a defense-dominated world.

10602 **Accelerators for heavy-ion fusion.** Bangerter, R. (Lawrence Livermore Lab., Livermore, CA). *Journal of Fusion Energy;* 5: No. 1, 17-22(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

The author discusses accelerators for heavy-ion fusion rather than accelerators for strategic defense systems, focusing first on generic fusion issues. The author maintains that a sensible fusion system must satisfy three conditions: the total capital cost of the system must be acceptable; the cost of electricity must also be acceptable, and there must be a reasonable way to get from where we are today to where we want to be ultimately, i.e., there must be a sensible R&D path. The author believes that inertial confinement fusion (ICF) provides a reasonable R&D path and explains why. The results of the heavy-ion experiments performed have tested only transverse beam dynamics. The author believes that heavy-ion fusion is a promising fusion option and that multistage accelerators are capable of satisfying the engineering requirements of fusion power production.

10603 **Liquid crystal devices for laser systems.** Jacobs, S.D. (Univ. of Rochester, Rochester, NY). *Journal of Fusion Energy;* 5: No. 1, 65-76(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

Liquid crystals offer new opportunities for the fabrication of optical devices for laser applications. The fluidlike nature of monomeric materials provides for a large, clear aperture capability with excellent optical quality, while the rigid nature of polymeric materials promotes environmental stability in a free-standing film. Because of their natural birefringence, liquid crystals can be used in situations where anisotropic crystalline solids are not available. Suitable applications include their use as polarizers, retarders, notch filters, Solc or Lyot filters, Kerr effect shutters, nonlinear frequency converters, and nonlinear optical elements. The three classifications of liquid crystals are discussed: smectic, nematic, and cholesteric.

10604 **Damage resistance of coated optics.** Wadt, WaR. (Los Alamos Natl. Lab., Los Alamos, NM). *Journal of Fusion Energy;* 5: No. 1, 57-64(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

The Strategic Defense Initiative (SDI) demands dramatic improvement in the performance of optical coatings beyond the current state of the art, according to the author. The author presents the approach being taken toward this problem at Los Alamos, where an Optical Damage program has been set up to develop damage-resistant optical coatings for high-power visible and ultraviolet lasers in strategic defense, inertial confinement fusion, and special isotope separation. For strategic defense, the program is addressing ground-based lasers (GBL), specifically the rf linac free-electron laser (FEL) being developed at Los Alamos, and the Xef laser, Raman-shifted in H_2 (EMRLD), being developed by AVCO and Rocketdyne. Since the eventual goal of the FEL program is a laser around 0.5-1.0 micrometers, the Optical Damage Program at Los Alamos is concerned with the entire wavelength range between 0.25 and 1.0 micrometers.

10605 **RF accelerators for Fusion and strategic defense.** Jampson, R.A. (Los Alamos Natl. Lab., Los Alamos, NM). *Journal of Fusion Energy;* 5: No. 1, 23-32(Mar 1986). (CONF-850476—).

From Symposium on lasers and particle beams for fusion and strategic defense; Rochester, NY, USA (18 Apr 1985).

This discussion is intended to relate rf linear accelerators to the topics of fusion and strategic defense. The author stresses that rf linacs are a relatively mature technology and that they are playing direct and auxiliary roles in both of these fields. The Los Alamos Meson Physics Facility (LAMPF) is discussed as an example of high-intensity rf linacs. The auxiliary role of rf linacs in fusion is for materials testing, and the direct role is for direct drivers in heavy-ion fusion. For SDI, the particle-beam technology is shown to be a good candidate for discrimination missions and also for lethality missions, according to the author. The free-electron laser is mentioned as a forerunner among the laser candidates.

10606 **Lithium ion source development for light-ion fusion: Overview of progress during the last two years.** Gerber, R.A.; Olsen, J.N. (Sandia National Labs., Albuquerque, NM 87185). pp 30 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). Contract AC04-76DP00789.

Lithium flashover sources have been investigated as near-term anode sources. Dielectric-filled grooves in the anode flash when the voltage is applied to the diode, forming an anode plasma. Research using a variety of lithium salts as the dielectric material has identified several lithium sources, one of which is presently being used for the PBFA-II pulse power testing. Although these sources may not satisfy all the requirements for target experiments, this research has produced >80% pure lithium ion beams. One leading candidate for the optimum ion source for the PBFA-II target experiments is referred to as the BOLVAPS/LIBORS scheme. BOLVAPS is a way to produce a thin lithium layer near the anode surface by rapid ohmic heating of a thin-film laminate containing lithium. The vapor is then ionized by LIBORS, which is a laser technique capable of producing a singly ionized lithium plasma. The technique has the potential of providing a preformed, dense (10/sup 17/ cm/sup 3/), thin (1 mm) lithium plasma over the entire anode surface. Basic research has been completed on both phases of this scheme. Measurements of the neutral lithium atom density has shown that BOLVAPS is a viable technique to produce the necessary layer of lithium. Laboratory experiments using a well characterized vapor source have shown that LIBORS produces a fully ionized plasma. Demonstration experiments combining the two techniques have resulted in ion densities within a factor of five of that required for PBFA II. A liquid lithium field emission ion source is another leading candidate for the optimum ion source. An overview of the various elements of the lithium ion source program is given.

10607 **Surface discharges as soft X-ray flashlamps.** Woodworth, J.R.; Hanson, D.L.; Jaramillo, W.H. (Sandia National Labs., Albuquerque, NM 87185). pp 32 of Conference record of the 1986 IEEE international conference on plasma science. Piscataway, NJ; IEEE Service Center (1986). Contract AC04-76DP00789.

The XUV and soft X-ray photons radiated by surface discharges were monitored with three filtered Alcathode XRDs which allowed the authors to divide the energy spectrum into 10-20 eV, 20-70 eV, and above 70 eV regions. A thin Ni-foil bolometer, with a flat response across this spectral region, was used to check the energy measurements made with the XRDs. Typical discharges with a peaking capacitor radiated peak XUV powers of 15-25 MW into all-space in a 280-ns wide pulse (FWHM). Total XUV energies were 5-7 J/pulse. The plasma emitted by these discharges was detected by Faraday cups. It had both fast (20 cm/μs) and slow (10-15 cm/μs) components. This plasma could be partially contained by leading the return current thru vanes in front of the discharge. Voltage and current measurements indicate that the discharge impedance rapidly collapses (50-100 ns) to a value of 80-100 milli-Ohms, suggesting that a very low impedance driver would be the best match to these discharges.

10608 **High-yield direct drive implosion experiments on Nova.** Lane, S.M.; Cable, M.; Prussin, S.G.; Glendinning, G.; Lerche, D.; Munro, D.; Richardson, M.C.; Roback, D.D.; Keck, R.L. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 132-133 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Four targets were irradiated with 0.35-μm laser light using nominally a 1-ns 20-kJ square pulse. Three shots which gave neutron yields of 0.95-1.1 X 10/sup 13/ used approximate tangential focusing (8-9R). One target produced half that yield when the beam spot on target was reduced in size (6R). No difference in yield was observed for converging compared to diverging illumination. The uncoated glass spheres were 950-1030 μm diameter with wall thicknesses between 1.9 and 2.7 μm and had fuel fills of 12-14-atm DT.

Neutron yields were measured by two independent detector systems calibrated to 10% that responded to the /sup 62/Cu and /sup 64/Cu activity induced in two copper disks placed near the target. The burn averaged ion temperature was determined using a time-of-flight system consisting of a quenched NE111 plastic scintillator with a microchannel plate photomultiplier placed 19.5 m from the target to measure the neutron energy Doppler broadening. The neutron energy resolution was 30 keV FWHM. Temperatures were obtained on two shots (7.8 +. 1.5 and 10.8 +. 1.5 keV).

10609 **Gold disk experiments using the Nova laser.** Kauffman, R.L.; Cable, M.; Drake, R.P.; Kornblum, H.; Lasinski, B.; Turner, R.E. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 132 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Preliminary experiments have been performed using the Lawrence Livermore National Laboratory Nova laser to study the coupling of 0.35-μm light to solid Au targets. Single beams of Nova were frequency tripled to 0.35-μm wavelength producing pulses with energies up to 2 kJ in a 1-ns square pulse. These beams irradiated 2-mm Au disks in spot sizes varying from 250 to 1500 μm for incident intensities in the range from 6 X 10/sup 13/ to 2 X 10/sup 15/ W/cm/sup 2/. Energy absorption and coupling mechanisms are studied as a function of incident intensity and angle. Preliminary results indicate that absorption at 0.35-μm wavelength >90% at intensities up to 2 X 10/sup 15/ W/cm/sup 2/. X-ray conversion efficiencies vary from >70% at 6 X 10/sup 13/ W/cm/sup 2/ to <40% above 10/sup 15/W/cm/sup 2/. This dependence is greater than observed at Argus using much less energy and smaller spots.

10610 **Scattered light from plasmas produced by Nova.** Drake, R.P.; Turner, R.E.; Phillion, D.W. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 132 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

Nova is the first laser to irradiate targets with many kilojoules of 0.35μm light using its ten arms. It is also the first laser to irradiate a target with more than 1 kJ of well-polarized 0.35-μm light from a single arm. This paper reports observations of scattered light during such irradiations. The experiments used 1-ns pulses. The authors measure the angular distributions of light scattered near the incident frequency, near half of the incident frequency, and in a range of frequencies between. They also measure the timing of the scattered light at a number of frequencies and the time-resolved spectrum in one- or two-wavelength bands on each shot. These measurements allow them to detect evidence of Brillouin scattering reflected laser light, Raman scattering, and the two-plasmon decay instability. Other diagnostics provide supporting information.

10611 **Raman scattering from inhomogeneous plasmas.** Batha, S.H.; Seka, W.; Simon, A.; Goldman, L.M. (Univ. Rochester, Lab. for Laser Energetics, Rochester, NY 14623). pp 132 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors have carried out experiments to determine the origin of broadband electromagnetic emission from laser-produced plasmas which has frequently been attributed to stimulated Raman scattering. Recent theory suggests an alternative explanation in terms of Thomson scattering, enhanced by the presence of a nonthermal electron distribution. The origin of this nonthermal distribution are streaming fast electrons produced by the two-plasmon decay (TPD) instability and/or resonance absorption occurring elsewhere in the plasma. The theory predicts two broad bands of scattered spectra, one with frequencies between the laser frequency and half of that frequency and the other one between the laser frequency and twice that frequency. The latter cannot be produced directly by instability. Thus observation of upscattered radiation is strong evidence for the enhanced Thomas scattering process. The experiments were carried out on the GDL single-beam laser facility at the Laboratory for Laser Energetics. The laser operated at 527 nm with energies ranging up to 200 J and pulse lengths around 700 ps. Flat targets made of CH foils were irradiated at intensities up to 2 X 10/sup 15/ W/cm/sup 2/. The Raman spectra were photographed using two 1/4-m spectrographs.

10612 **Experimental tests of induced spatial incoherence using short laser wavelength.** Obenschain, S.P.; Grun, J.; Herbst, M.J.; Kearney, K.J.; Manka, C.K.; McLean, E.A.; Mostovych, A.N.; Stamper, J.A.; Bodner, S.E.; Gardner, J.H. (U.S. Naval Research Lab., Plasma Physics Div., Laser Plasma Branch, Washington, DC 20375-5000). pp 132-133 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors have developed a laser beam smoothing technique called induced spatial incoherence (ISI), which can produce the highly uniform focal profiles required for direct-drive laser fusion. Uniform well-controlled focal profiles are required to obtain the highly symmetric pellet implosions needed for high-energy gain. In recent experiments, the authors' tested the effects of ISI on high-power laser-target interaction. With short laser wavelength, the coupling physics dramatically improved over that obtained with an ordinary laser beam.

10613 **Ablatively driven thick shell target implosions.** Richardson, M.C.; Audebert, P.; Jaanimagi, P.A.; Keck, R.L.; Marshall, F.J.; McCrory, R.L.; McKenty, P.W.; Roback, D.M.; Soures, J.M.; Verdon, C.P. (Univ. Rochester, Lab. for Laser Energetics, Rochester, NY 14627). pp 112 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors report the first detailed study of high-pressure (≦100-atm) DT-filled target implosions, ablatively driven by the 24-beam 2.5-kJ 351-nm nanosecond Omega facility. A comprehensive set of plasma, x-ray, and nuclear diagnostics has been used to characterize the laser-target interaction, the shell hydrodynamics, and the final core condition. These data have then been compared to predictions of the 1- and 2-D hydrodynamic codes LILAC and ORCHID, respectively, to assess thee degree of implosion symmetry and the effects of the estimated level of target illumination uniformity.

10614 **High neutron yield laser fusion target studies with the 24-beam UV Omega system.** Marshall, F.J.; Richardson, M.C.; Keck, R.F.; McKenty, P.W.; Roback, D.M.; Verdon, C.P.; McCrory, R.L.; Soures, J.M. (Univ. Rochester, Lab. for Laser Energetics, Rochester, NY 14627). pp 112 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The authors report on implosions of large-diameter thin-walled DT-filled glass microballoons with the University of Rochester 24-beam UV laser system. The experiments were performed with up to 2.5 kJ of 351 nm, 500-700-ps pulses in 24 symmetrically placed f/3.7 laser beams. Illumination uniformity is estimated to have been ≈ 15% (rms) with corresponding peak-to-valley intensity variations of ≈ 60%. Targets employed consisted of 500- 1000-μm diam glass microballoons with 1-2- μm thick walls filled with equimolar mixtures of deuterium and tritium at 10 atm of pressure. A large number of plasma, x-ray, and nuclear diagnostics were used to measure the performance of these targets. These included plasma calorimeters for measuring the fraction of laser light absorbed in the target corona, space and time-resolved x-ray spectrographic and photographic instrumentation which measured x-ray emission dominated by that of the target shell, and nuclear instruments which diagnosed the areal densities of the compressed shell and compressed fuel core.

10615 **Laser driven shock wave measurements in the 100-Mbar range.** Phillion, D.W.; Kilkenny, J.D.; Ze, F.; Kauffman, R.; Campbell, E.M.; Munro, D.; Drake, R.P. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). pp 112 of International conference (XIV) on quantum electronics. Digest of technical papers. Piscataway, NJ; IEEE Service Center (1986). (CONF-860621—).

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

A well-known advantage of UV laser beams for high-irradiance laser plasma production is the higher ablation pressure and lower electron preheat compared to similar irradiances in the visible or IR. However, previous measurements have been limited to small spots by the available laser energy. In the present experiments, several of the 2-kJ3ω 1-ns laser beams of Nova have been used to produce laser irradiances up to 10/sup 16/ W/cm/sup -2/ with relatively large spot sizes. A single beam at normal incidence, or two beams at 30° to the normal, was focused onto aluminium targets. Spot sizes from $\approx$ 1mm to 150 μm gave irradiances from 10/sup 14/ to 10/sup 16/ W/cm/sup 2/. The shock transit time across steps on the rear of the target was observed using an optical streak camera filtered at 280 nm. The shock transit times give pressures up to 100 Mbar. The scaling of the ablation pressure with irradiance agrees with a simple 1-D model, implying little sideways loss of energy. The ablation pressure is also measured from the mass ablation rates of plastic coated aluminum targets and correlated with the optical spectroscopy. The preheat is estimated from spectroscopy of layered targets.

99 GENERAL AND MISCELLANEOUS

10616 **(ANL/EES-TM—304) Long-term projections of national, regional, and state population.** McDonald, J.F.; South, D.W. (Argonne National Lab., IL (USA)). Jul 1986. Contract W-31-109-ENG-38. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003644.

The projections prepared by the US Bureau of the Census are the best available projections of total US population. The DRI projections of population at the regional and state level to the year 2008 are the best available and are consistent with the US Bureau of the Census projections of total US population. The DRI regional and state projections can be extended from 2008 to 2030 with a simple model based on economic opportunity, although an even simpler model - constant shares - is used for the 1985 test runs. The US Bureau of the Census prepares the best available projections of the US age-sex distribution.

10617 **(CONF-860586—4) World conference on continuing engineering education. Volume 1. Proceedings.** Grayson, L.P.; Biedenbach, J.M. (eds.). (Oak Ridge Associated Universities, Inc., TN (USA)). May 1986. Contract AC05-76OR00033. 7p. Inst. of Electr. and Electronics Eng., Inc., 345 E.47th St., New York, NY 10017. File Number TI87000313.

From World conference on continuing education; Lake Buena Vista, FL, USA (7 May 1986).

ORAU's principal work is in energy-related research, education, training, and technical assistance, and it offers courses in such technical areas as health physics, internal dosimetry, and nuclear medicine. This paper discusses DOE-sponsored continuing engineering education programs and courses available through ORAU. A brief description of other energy-related opportunities available through ORAU is given. (DLC)

10618 **(CONF-8609170—1) Currency flaw severity.** Johnson, C.; Burnett, M.; Goodman, C.; Sherrod, R.; Schmoyer, R.; Harrison, C.; Uppuluri, R. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87000355.

From International conference on machine inspection of printed security documents; Long Beach, CA, USA (25 Sep 1986).

A survey of currency flaw severity was carried out using 300 banknotes and 37 judges. Each judge assigned each note to one of five flaw severity categories. These categories correspond to severity grades of 1 to 5 with 1 equivalent to "always accepted" and 5 "never accepted." An average flaw severity grade for each note was obtained by taking the mean of the severity grades assigned to that note by the 37 judges. Thus, each note has a single numerical real-number flaw grade between 1 and 5. Mathematical modeling of the currency flaw survey results is continuing with some very promising initial results. Our present model handles common excess ink and missing ink flaw types quite well. We plan to extend the model to ink level, mash, setoff and blanket impression flaw types.

10619 **(EPRI-EM—4885) Field validation of mail surveys: A monograph from the advanced commercial survey methods (COMSURV) project: Final report.** Mihlmester, P.E.; McCarthy, P.M.; Zwack, W.A. (Applied Management Sciences, Inc., Silver Spring, MD (USA)). Nov 1986. 173p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920127.

This report presents the results of a demonstration to field validate commercial sector mail survey responses. The study was performed utilizing Virginia Power's 1985 Commercial Customer Survey (general and tailored versions of the questionnaire). The survey was focused on offices and retail food stores. Responses to the mail survey were validated by field visits to a sample of sites responding to the mail survey. Discrepancies between the mail response and field observation for selected variables, and the reason for these discrepancies (to the extent available) were noted. The results were then analyzed to determine variables which are suitable or unsuitable for inclusion in mail surveys. The mail survey performed quite well in the majority of cases for the variables represented. Relative errors were usually small.

9901 Management

10620 **(DOE/IG—0233) Report on Sandia Corporation defined benefit pension plans, Albuquerque, New Mexico.** (USDOE Office of Inspector General, Albuquerque, NM. Office of Audits). 12 Dec 1986. 14p. OSTI, PO Bx 62, Oak Ridge, TN 37831. File Number TI87003448.

This report concerns payments by the Sandia Corporation to employee pension plans. The audit disclosed that in 1984 the Department incurred unnecessary costs of $19.2 million because Sandia made payments into its two pension plans even though information contained in Sandia's actuarial consultants' reports showed that the funds were overfunded by $77.7 million at the beginning of the year. During the preceding three years, similar payments were made which added to plan overfunding. Sandia had based pension plan payments on very conservative actuarial assumptions. Albuquerque did not agree with the findings and recommendations. A summary of management's comments and the response are included in the report.

10621 **(DOE/MA—0214) DOE real property: A yearly statistical handbook.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). Dec 1986. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003298.

This is the first annual Department of Energy (DOE) Handbook of Real Property Statistics. Unless otherwise noted, the information was compiled from the Real Property Inventory System (RPIS). The RPIS is an integrated data base of real property information which is maintained by the DOE field organizations. Data are housed in the DOE central computer facility in Germantown, Maryland. Data entry by field personnel is continuous throughout the year via phone line linkages and on-screen documentation. System maintenance and development are accomplished by the Office of Computer Systems and Telecommunications Management. The Headquarters custodian for the RPIS is the Office of Project and Facilities Management. Field organizations are solely responsible for the accuracy and timeliness of the basic data. Access to the RPIS is controlled through authorized password holders whose eligibility is determined by the respective field organizations and the Office of Project and Facilities Management.

10622 (DP-MS—86-93) Networked analytical sample management system. Kerrigan, W.J.; Spencer, W.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1986. Contract AC09-76SR00001. 26p. (CONF-860944—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002659.

From 29. conference on analytical chemistry in energy technology; Knoxville, TN, USA (29 Sep 1986).

Since 1982, the Savannah River Laboratory (SRL) has operated a computer-controlled analytical sample management system. The system, pogrammed in COBOL, runs on the site IBM 3081 mainframe computer. The system provides for the following subtasks: sample logging, analytical method assignment, worklist generation, cost accounting, and results reporting. Within these subtasks the system functions in a time-sharing mode. Communications between subtasks are done overnight in a batch mode. The system currently supports management of up to 3000 samples a month. Each sample requires, on average, three independent methods. Approximately 100 different analytical techniques are available for customized input of data. The laboratory has implemented extensive computer networking using Ethernet. Electronic mail, RS/1, and online literature searches are in place. Based on our experience with the existing sample management system, we have begun a project to develop a second generation system. The new system will utilize the panel designs developed for the present LIMS, incorporate more realtime features, and take advantage of the many commercial LIMS systems.

10623 (INIS-mf—10515, pp 35-37) **Experience of NIC in compiling search studies.** Vanek, V. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The system of on-offer publishing of studies in the field of peaceful uses of nuclear energy is evaluated. A survey is given of studies which have been completed or are being elaborated by the Nuclear Information Centre. (E.S.).

10624 (K/CSD/TM—60) Environmental Milestone Management and Analysis System: User's manual. Arrowood, L.F. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Aug 1986. Contract AC05-84OT21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003585.

The Environmental Milestone Management and Analysis System is a collection of computer programs which have been implemented for the Health, Safety, Environment, and Accountability Division at the Y-12 Plant to assist managers in tracking project milestones and reporting progress on environmental activities. By calling external graphics software routines from within FORTRAN programs, the system can generate schedule milestone charts which use information retrieved from databases. In addition to its graphics capabilities, this database management system provides reports which identify those milestones due for completion within a specific time period; these can be subdivided further by responsible project manager or government agency.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 9206, 10434, 10439

10625 (AD-A—172224/8/XAB) Distributed control in computer networks and cross sections of colored multidimensional bodies. Interim research report. Kranakis; Vitanyi, P.M. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Computer Science). Apr 1986. 19p. (MIT/LCS/TM—304). NTIS, PC A02/MF A01.

The number of messages to match a pair of processes in a multiprocessor network with mobile processes is a measure for the cost of setting up temporary communication between processes. The authors establish lower bounds on the average number of point-to-point transmissions between any pair of nodes in the context. The present analysis allows for the possibility of multiple transmissions (as opposed to a single one) between any two nodes, and also for the possibility of multiple queries (as opposed to the two, i.e., post and a single query considered before). Applications of the results include lower bounds on the number of messages for distributed s-matching, that is, matching a group of s processes, and distributed s-mutual exclusion, that is, s-1 processes may enter a critical section simultaneously, but s processes may not, for s > or = 2. The idea of the proof of the combinatorial result needed for this analysis is further extended to obtain a lower bound on the average number of colors occurring in random cross sections of colored, multidimensional bodies in terms of the total (multidimensional) volume of each color in the whole body.

10626 (AD-A—172362/6/XAB) Optical processing. Final report. Walker, A.C.; Taylor, W. (Dayton Univ., OH (USA). Research Inst.). Jun 1986. 149p. NTIS, PC A07/MF A01.

The major part of this work is directed towards development of large arrays of optically bistable gates for parallel-processing applications. An important requirement of such arrays is an efficient system of illumination. Assuming a clear separation between each gate and its neighbors, then it is necessary to break the laser beam, which acts as the power input to the array, into a corresponding pattern of focused beamlets. Holographic techniques are particularly suited to this purpose. In addition, it is anticipated that holographic interconnects will play an important role in combining numbers of optical-gate arrays to form parallel optical digital processors. With these requirements in mind, a facility was assembled that was dedicated to the production of holographic optical elements (HOEs) for specific use in optical digital circuits. To ensure high-efficiency exploitation of available laser power, Dichromated Gelatin (DCG) was chosen as the (volume) emulsion.

10627 (AD-A—172445/9/XAB) Complexity of parallel algorithms. Anderson. (Stanford Univ., CA (USA). Dept. of Computer Science). Nov 1985. 72p. (STAN-CS—86-1092). NTISMF A01.

This thesis addresses a number of theoretical issues in parallel computation. There are many open questions relating to what can be done with parallel computers and what are the most effective techniques to use to develop parallel algorithms. The author examines various problems in hope of gaining insight to the general questions. One topic investigated is the relationship between sequential and parallel algorithms. Introduced is the concept of a P-complete algorithm to capture what it means for an algorithm to be inherently sequential . It is shown that a number of sequential greedy algorithms are P-complete, including the greedy algorithm for finding a path in a graph. However, a problem is not necessarily difficult if an algorithm to solve it is P-complete. In some cases, the natural sequential algorithm is P-complete but a different technique gives a fast parallel algorithm. This shows that it is necessary to use different techniques for parallel computation than are used for sequential computation. Fast parallel algorithms for a number of simple graph theory problems are given. The algorithms illustrate a number of different techniques that are useful for parallel algorithms. The final topic that we address is parallel approximation of P-complete problems.

10628 (ANL—86-44) A formal notation for hardware and software verification. Chapman, R.O.; Gabriel, J.R. (Argonne National Lab., IL (USA)). Oct 1986. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003295.

Some years ago a theory was published describing compilation of digital logic system build descriptions (list of behaviors for elementary components and connections between them) into recursively computable system behavior descriptions. The current work describes an analogous theory for computer programs.

10629 (ANL/MCS-TM—82) On the identification of active constraints. Burke, J.V.; More, J.J. (Argonne National Lab., IL (USA)). Sep 1986. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003083.

We study nondegeneracy conditions which guarantee that the optimal active constraints are identified in a finite number of iterations. Results of this type have only been established for a few algorithms, and then under restrictive hypothesis. Our main result is a characterization of those algorithms which identify the optimal constraints in a finite number of iterations. This result is obtained with a nondegeneracy assumption which is equivalent, in the standard nonlinear programming problem, to the assumption that there is a set of strictly complementary Lagrange multipliers. As an important consequence of our results, we show that this characterization applies to gradient projection and sequential quadratic programming algorithms. 19 refs.

10630 (ANL/MCS-TM—86) SCHEDULE: Tools for developing and analyzing parallel Fortran programs. Dongarra, J.J.; Sorensen, D.C. (Argonne National Lab., IL (USA)). Nov 1986. Contract AC05-84OR21400;FG02-85ER25001;W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003077.

This paper describes an environment for the transportable implementation of parallel algorithms in a Fortran setting. By this we mean that a user's code is virtually identical for each machine. The main tool in this environment is a package called SCHEDULE which has been designed to aid a programmer familiar with a Fortran programming environment to implement a parallel algorithm in a manner that will lend itself to transporting the resulting program across a wide variety of parallel machines. The package is designed to allow existing Fortran subroutines to be called through SCHEDULE, without modification, thereby permitting users access to a wide body of existing library software in a parallel setting. Machine intrinsics are invoked within the SCHEDULE package, and considerable effort may be required on our part to move SCHEDULE from one machine to another. On the other hand, the user of SCHEDULE is relieved of the burden of modifying each code he desires to transport from one machine to another. 17 refs., 11 figs., 1 tab.

10631 (BNL—38792) Domain decomposition preconditioners for elliptic problems in two and three dimensions. Pasciak, J.E. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 10p. (CONF-861189—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002590.

From Numerical algorithms for modern parallel computer workshop; Minneapolis, MN, USA (3 Nov 1986).

In this talk, we shall describe some techniques for developing domain decomposition preconditioners for elliptic boundary value problems in two and three dimensions. We consider the case where more than two subdomains meet at an interior point of the original domain; this allows a subdivision into an arbitrary number of subdomains without the deterioration of the iterative convergence rates for the resulting algorithm. We set up a general framework for the development of preconditioners by domain decomposition. As examples of the application of these techniques, we derive domain decomposition preconditioners for elliptic problems in two and three dimensions.

10632 (CNEA-NT—18/85) New version of the DOT 3.5. Development and implementation. Sbaffoni, M.M.; Abbate, M.J. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). 1985. 14p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700309.

The use of code DOT 3.5 in calculations that involve neutron thermalization processes in systems with a strong upscattering effect, has shown several problems, i.e. arise of negative fluxes, instability of the solutions, and random convergence. Because of these undesirable results, a new version of the code was developed, which maintains the possibilites of the former one and adds, as option, the utilization of a new upscattering acceleration method, called 'differential method' or 'group by group'. It is more adequate for this kind of cases and solves, with the addition of a few other minor modifications, the above mentioned problems. Since this new version includes the original one, the modifications described in this report, in particular those of input and output features, are an addendum to the corresponding user's manual.

10633 (CNEN-DR—123/84) Citham a computer code for calculating fuel depletion-description, tests, modifications and evaluation. Alvarenga, M.A.B. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro. Dept. de Reatores). Dec 1984. 65p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700480.

The CITHAN computer code was developed at IPEN (Instituto de Pesquisas Energeticas e Nucleares) to link the HAMMER computer code with a fuel depletion routine and to provide neutron cross sections to be read with the appropriate format of the CITATION code. The problem arised due to the efforts to addapt the new version denomined HAMMER-TECHION with the routine refered. The HAMMER-TECHION computer code was elaborated by Haifa Institute, Israel within a project with EPRI. This version is at CNEN to be used in multigroup constant generation for neutron diffusion calculation in the scope of the new methodology to be adopted by CNEN. The theoretical formulation of CITHAM computer code, tests and modificatins are described.

10634 (CONF-851276—1) Matrix multiplication on a multicomputer system with switchable main memory modules. Baru, C.K.; Thakore, A.K.; Su, S.Y.W. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). 1985. Contract FG05-84ER13285. 10p. NTIS, PC A02. File Number DE87002498.

From 1. annual international conference on supercomputing systems; St. Petersburg, FL, USA (16 Dec 1985).

The issues involved in implementing algorithms for large-scale numeric computations, specifically matrix multiplication, in a dynamically partitionable multicomputer system (SM3) are discussed. SM3, a multicomputer system with switchable main memory modules, supports the efficient execution of parallel algorithm by (1) allowing the sharing of switchable main memory modules between computers, (2) supporting network partitioning, and (3) employing global control lines to efficiently support inter-processor communication. Timing equations are derived for the matrix multiplication operation and an analysis is presented. The SM3 is compared with a conventional network system in order to highlight the differences in the two architectures. 13 refs., 8 figs.

10635 (CONF-860880—39) Implementation of a fully parallel algorithm for the symmetric eigenvalue problem. Dongarra, J.J.; Sorensen, D.C. (Argonne National Lab., IL (USA)). Aug 1986. Contract AC05-84OR21400;W-31-109-ENG-38;FG02-85ER25001. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001524.

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

In this paper we present a parallel algorothm for the symmetric algebraic eigenvalue problem. The algorithm is based upon a divide and conquer scheme suggested by Cuppen for computing the eigensystem of a symmetric tridiagonal matrix. We extend this idea to obtain a parallel algorithm that retains a number of active parallel processes that is greater than or equal to the initial number throughout the course of the computation. Computation of the eigensystem of the tridiagonal matrix is reviewed. Also, brief analysis of the numerical properties may occur. We show how to explicitly overlap the initial reduction to tridiagonal form with the parallel computation of the eigensystem of the tridiagonal matrix. The algorithm is therefore able to exploit parallelism at all levels of the computation and is well suited to a variety of architectures. Computational results have been presented in [4] for several machines. These results are very encouraging with respect to both accuracy and speedup. A surprising result is that the parallel algorithm for the tridiagonal case, even when run in serial mode, can be significantly faster than the previously best sequential algorithm on large problems, and is effective on moderate size problems when run in serial mode. 12 refs.

10636 (CONF-8609173—3) **Communication reduction in parallel sparse Cholesky factorization on a hypercube.** George, A.; Liu, J.W.H.; Ng, E. (Oak Ridge National Lab., TN (USA); York Univ., Toronto, Ontario (Canada). Dept. of Computer Science). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002625.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

We consider the problem of reducing data traffic among processor nodes in the parallel factorization of a sparse matrix on a hypercube multiprocessor. A task assignment strategy based on the structure of an elimination tree is presented. This assignment is aimed at achieving load balancing among the processors and also reducing the amount of processor-to-processor data communication. Some experimental results on the performance of this scheme are presented. 8 refs., 2 tabs.

10637 (DOE/ER—0306) **Summaries of the FY 1986 Applied Mathematical Sciences Research program.** (USDOE Office of Energy Research, Washington, DC. Scientific Computing Staff). Nov 1986. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003286.

A convenient compilation of summaries of the individual research projects that constitute the Applied Mathematical Sciences research subprogram managed by the Director, Scientific Computing Staff, Office of the Director of Energy Research, Department of Energy, is given. This new office, organized in 1984, consists of the applied mathematical sciences research activity formerly under the Division of Engineering, Mathematical and Geosciences, Office of Basic Energy Sciences, Office of Energy Research, and the management of the expanded National Magnetic Fusion Energy Computer Network formerly under the Office of Magnetic Fusion Energy.

10638 (DOE/ER/13285—T1) **A dynamic multicomputer system for managing scientific and engineering databases: Final technical report, August 1, 1984-July 31, 1986.** Su, S.Y.W. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). Sep 1986. Contract FG05-84ER13285. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002497.

Research and accomplishments are summarized in the following four areas: 1.1 - Architectural Design of a Dynamically Partitionable Multicomputer System with Switchable Main Memory Modules (SM3). 1.2 - Performance Analysis of SM3. 1.3 - Simulation of Operations in SM3. 1.4 - Parallel Algorithms for Matrix Computations Using SM3. 1.1 - Architectural Design of SM3. The architecture of SM3 is based on three key concepts, viz., switchable memory, partitionable common bus, and global control lines.

10639 (DOE/ER/25007—1) **Conic algorithms for unconstrained minimization with special consideration of problems with large sparse hessians: A summary of activities during the period August 1, 1985-July 31, 1986.** Ariyawansa, K.A. (Washington State Univ., Pullman (USA). Dept. of Pure and Applied Mathematics). 1986. Contract FG06-85ER25007. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003136.

The four objectives of the research program are presented. (WRF)

10640 (ENEA-RT-TIB—85/22) **An efficient method to calculate the exponential integrals E/sub n/ (x).** Landini, P.; Lorenzutta, S.; Premuda, F. (ENEA, Rome (Italy)). Oct 1985. 72p. NTIS (US Sales Only), PC A04. File Number DE87900283.

A stable algorithm is presented for the calculation of the exponential integrals E/sub n/ (x), which is valid whatever n $\geqq$ 1 and x > 0. The E/sub n/ (n) are obtained, for decreasing values of n, by a step - by - step Taylor series expansion procedure, starting from a known asymptotic expansion valid for large values of n and x. Once E/sub n*/ (n*) is accurately known for n* = [x] + 1, a few time repeated Taylor series expansion leads to E/sub n*/ (x) and stable backward (forward) recurrences lead to E/sub n/ (x) for n < n* (n > n*). Accurate numerical results and tables for E/sub n/ (x) are also given.

10641 (ENEA-RT-VEL—85/11) **High-accuracy explicit spectral solvers for stiff, non stiff and highly-oscillatory differential systems.** Norelli, F. (ENEA, Casaccia (Italy). Dipartimento Reattori Veloci). Dec 1985. 64p. NTIS (US Sales Only), PC A04/MF A01. File Number DE87900286.

Despite of their interesting characteristics, solvers based on best approximations in the Chebyshev sense are not used in step-by-step calculations for their lack of reliability. In order to make this procedure allowable, a new method is introduced in this paper, for generating explicit easily-programmable and time saving spectral schemes, able to attain highly accurate results for initial conditions differential systems, favorably comparing with the ordinary Pade techniques. A theoretical outline and several numerical tests may support the opinion of a possible wide use of the method for stiff, non-stiff and highly-oscillatory differential systems.

10642 (INS—1988/P-3/E/B) **Universal microcomputer ABM 80 for data processing and measurement devices control.** Jagiello, S.; Kozminski, A.; Plominski, M.; Rzymkowski, K. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1983. 20p. (In Polish). Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland.

The main features of the universal microcomputer ABM-80 with microprocessor INTEL 8080 are described. ABM-80 works with the measurer AZAR and the register ERD-102 or with other equipment with similar input/output parameters. Monitor program is an integral part of the microcomputer.

10643 (IPPJ—725, pp 11-24) **Numerical solutions of the Vlasov equation.** Satofuka, Nobuyuki; Morinishi, Koji; Nishida, Hidetoshi. (Kyoto Univ. of Industrial Arts and Textile Fibers, Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

A numerical procedure is derived for the solutions of the one- and two-dimensional Vlasov-Poisson system equations. This numerical procedure consists of the phase space discretization and the integration of the resulting set of ordinary differential equations. In the phase space discretization, derivatives with respect to the phase space variable are approximated by a weighted sum of the values of the distribution function at properly chosen neighboring points. Then, the resulting set of ordinary differential equations is solved by using an appropriate time integration scheme. The results for linear Landau damping, nonlinear Landau damping and counter-streaming plasmas are investigated and compared with those of the splitting scheme. The proposed method is found to be very accurate and efficient.

10644 (IPPJ—725, pp 66-73) **Moving finite element method for ICF target implosion.** Furuta, Junichi; Kawata, Shigeo; Niu, Keishiro. (Tokyo Inst. of Tech., Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

One-dimensional hydrodynamic codes for the analysis of ICF target implosion which include various effects have been developed, but most of them utilize the artificial viscosity (e.g. Von Neumann's viscosity) which cannot reveal accurately the shock waves. A gain of ICF target implosion is much due to the dissipation at the shock fronts, so it is necessary to express correctly the shock waves which are affected by the viscosity. The width of the shock waves is usually a few times as large as the length of mean-free-path, and we have to set about $10^4 - 10^5$ meshes for the shock waves. It is a serious problem because of the computional memories or CPU time. In the moving finite element (MFE) method, both nodal amplitudes and nodal positions move continuously with time in such a way as to satisfy simultaneous ordinary differential equations (OPDs) which minimize partial differential equation (PDE) residuals. In this paper, it is proposed to extend the MFE method for various one-dimensional hydrodynamic equations.

10645 (IPPJ—725, pp 74-85) **Numerical calculations on shock loaded materials.** Tanaka, Katsumi. (National Chemical Lab. for Industry, Yatabe, Ibaraki, Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The numerical technique for the analysis of shock waves in condensed materials by using the finite difference method of Lagrangian hydrodynamics is briefly described. Examples of the Lagrangian calculations for the flyer plate acceleration and implosion of D-T fuel by light ion beam are presented.

10646 (IPPJ—725, pp 86-98) **Dissipation terms in one-dimensional hydrodynamic code for ICF target.** Tamba, Moritake; Niu, Keishiro. (Institute of Physical and Chemical Research, Wako, Saitama, Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The one-dimensional hydrodynamic code so far used for the simulation of the target implosion in ICF, the artificial viscosity has been employed as the dissipation terms. This artificial viscosity depends on the mesh width of the space using in the simulation and is much large in comparison with the real viscosity. In this paper, it is shown that this artificial viscosity leads to the unreasonable fusion parameters depending on the used mesh width of the space. Several methods to modify the dissipation term are given in this paper.

10647 (IPPJ—725, pp 99-114) **Two-dimensional simulation of LIB target implosion.** Yamaguchi, Isho; Kawata, Shigeo; Niu, Keishiro. (Tokyo Inst. of Tech., Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The behavior of the imploding DT shell, subjected to non-uniformly distributed external pressure, is investigated numerically. This analysis is performed by using two-dimensional hydrodynamic code developed in our laboratory. Mixed Eulerian-Lagrangian Method is adopted in this code to avoid the disadvantages of pure Eulerian and pure Lagrangian Method. Results are shown for several cases and it is shown that the fluctuation of the pressure applied to DT fuel layer must be kept under a few percent.

10648 (IPPJ—725, pp 115-119) **Simulation of instability of cylindrically converging shock waves.** Itoh, Toshiaki; Abe, Kanji. (Tokyo Univ., Japan). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

Motions of cylindrically converging shock waves are simulated numerically. Spatially two-dimensional fluid dynamic equations, which contain the azimuthal angle theta as well as the radius r as independent variables, are solved. A cylindrical shock tube problem is examined. The shape of the converging shock wave is always stable and has a tendency to become circular. The flow behind the shock wave, however, is unstable. The instability growth rate of perturbation increases with wave length of the perturbation. The results of simulation are compared to those of experiment.

10649 (IPPJ—725, pp 222-226) **Vector calculation of particle code.** Nishiguchi, A.; Yabe, T.; Orii, S. (Osaka Univ., Suita, Japan. Inst. of Laser Engineering). Mar 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE87780044. (CONF-8411277—).

From Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion; Nagoya, Japan (15 Nov 1984).

The development of vector computer requires the modification of the algorithm into a suitable form for vector calculation. Among many algorithms, the particle code is a typical example which has suffered a damage in the calculation on supercomputer owing to its possibility of recurrent data access in collecting cell-wise quantities from particle's quartities. In this article, we report a new method to liberate the particle code from recurrent calculations. It should be noticed, however, that the method may depend on the architecture of supercomputer, and works well on FACOM VP-100 and VP-200: the indirect data accessing must be vectorized and its speed should be fast.

10650 (JAERI-M—85-010) **Users' manual for the FTDRAW (Fault Tree Draw) code.** Oikawa, Tetsukuni; Hikawa, Michihiro; Tanabe, Syuichi; Nakamura, Norihiro. (Japan Atomic Energy Research Inst., Tokyo; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1985. 65p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700311.

This report provides the information needed to use the FTDRAW (Fault Tree Draw) code, which is designed for drawing a fault tree. The FTDRAW code has several optional functions, such as the overview of a fault tree output, fault tree output in English description, fault tree output in Japanese description and summary tree output. Inputs for the FTDRAW code are component failure rate information and gate information which are filed out by a execution of the FTA-J (Fault Tree Analysis-JAERI) code system and option control data. Using the FTDRAW code, we can get drawings of fault trees which is easy to see, efficiently.

10651 (Juel—2053) **Unfolding of nuclear radiation spectra by means of the least square method.** Belitz, H.J.; Hinken, M.; Mohnes, I. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik). Apr 1986. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87750309.

Using Least Square Methods on easily may get solutions of the convolution integral by iteration, satisfactory for practical purposes. For continuum radiation the method takes into account the condition that the radiation intensities must be nonnegative. For a line radiation of known structure the parameters characterising that structure are determined. The sum of the squares of the residuals gives the accuracy of the deconvolution procedure. The programs for the described methods need little space; they may be implemented even in small computers.

10652 (KFKI—1986-75/M) **Fault tolerance.** Bona, G.; Erenyi, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1986. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87900267.

There are two complementary approaches which can be adopted to provide reliable computing systems. The direct and obvious course of action is to attempt to ensure that a system is, and remains free from faults. This requires that: potential faults are avoided, remaining faults are exposed and eliminated before reliance is placed on the system, new faults do not develop. This approach is termed fault prevention or fault avoidance. The second approach accepts that an implemented system will never be perfect, and therefore measures are required to enable the system to cope with the faults that remain or develop. This approach is called fault tolerance. Techniques of these two approaches are discussed with respect to both hardware and software. 67 refs.

10653 **(LA-UR—86-3400) Quasilinear systems, semigroups, and nonlinear coupling.** Pimbley, G.H. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 10p. (CONF-860794—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001956.

From Nonlinear analysis and applications; Arlington, TX, USA (28 Jul 1986).

It is known that the semigroup S(t) corresponding to the sum A + B of two non-commuting generators, each having semigroups S/sub A/(t), respectively S/sub B/(t), is given by the Trotter product S/sub A/(t)*S/sub B/(t) = lim n→∞[S/sub A/(t/n)S/sub B/(t/n)]/sup n/ provided the latter converges. We apply this principle in treating a quasilinear system with nonlinear coupling. The conjecture is that some hydrodynamic systems may have semigroups. 9 refs.

10654 **(LA-UR—86-3771) A UNIX interface to supercomputers.** McBryan, O.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 15p. (CONF-8505327—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002921.

From ARO meeting on workstations and supercomputing; Newark, DE, USA (1 May 1985).

We describe a convenient interface between UNIX-based work-stations or minicomputers, and supercomputers such as the CRAY series machines. Using this interface, the user can issue commands entirely on the UNIX system, with remote compilation, loading and execution performed on the supercomputer. The interface is not a remote login interface. Rather the domain of various UNIX utilities such as compilers, archivers and loaders are extended to include the CRAY. The user need know essentially nothing about the CRAY operating system, commands or filename restrictions. Standard UNIX utilities will perform CRAY operations transparently. UNIX command names and arguments are mapped to corresponding CRAY equivalents, suitable options are selected as needed, UNIX directory tree filenames are coerced to allowable CRAY names and all source and output files are automatically transferred between the machines. The primary purpose of the software is to allow the programmer to benefit from the interactive features of UNIX systems including screen editors, software maintenance utilities such as make and SCCS and in general to avail of the large set of UNIX text manipulation features. The interface was designed particularly to support development of very large multi-file programs, possibly consisting of hundreds of files and hundreds of thousands of lines of code. All CRAY source is kept on the work-station. We have found that using the software, the complete program development phase for a large CRAY application may be performed entirely on a work-station.

10655 **(LA-UR—86-3855) The Kuramoto-Sivashinsky equation: Spatio-temporal chaos and intermittencies for a dynamical system.** Nicolaenko, B. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 30p. (CONF-860797—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002906.

From Conference on physico-chemical hydrodynamic instabilities; La Rabida, Spain (11 Jul 1986).

We survey some recent results on the finite-dimensional behavior of the Kuramoto-Sivashinsky equation. We outline how it is rigorously equivalent to a finite dimensional dynamical system on a finite "inertial" manifold; a geometric approach to the construction of such a manifold is given. We give some examples of computational simulations supporting the evidence for a low-dimensional vector field which rules the bifurcations of the inertial manifold. 45 refs., 21 figs.

10656 **(LA-UR—86-3887) Fast parallel algorithms for the Moore-Penrose pseudo-inverse.** Benson, M.W.; Frederickson, P.O. (Los Alamos National Lab., NM (USA); Lakehead Univ., Thunder Bay, Ontario (Canada). Dept. of Mathematical Sciences). 1986. Contract W-7405-ENG-36. 10p. (CONF-8609173—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002902.

From 2. conference on hypercube multiprocessors; Knoxville, TN, USA (29 Sep 1986).

We employ the concept of an approximate pseudo-inverse (API) of a singular linear operator A to construct algorithms that yield the Moore-Penrose pseudo-inverse solution $x^+ = A^+y$ to the singular system $Ax = y$. Such an algorithm is a nonmatrix representation of the Moore-Penrose pseudo-inverse A^+ of A. We are particularly interested in fast algorithms [executable in O(n) operations] that are fully efficient on parallel computers. One result presented concerns the construction of APIs for consistent problems and is applied to the two-dimensional free-boundary spline interpolation problem. For this problem, the conjugate gradient algorithm, preconditioned with an API, proves to be very effective. The V-cycle multigrid algorithm FAPIN is shown to be an API if the smoother satisfies a certain condition and proves to be very effective for Poisson's problem on a two-torus. We have demonstrated our algorithms for n close to one million on the iPSC hypercube at Christian Michelsen Institute, Bergen. 15 refs., 1 tab.

10657 **(PNL-SA—14223) Data analysis management: Goals and experience.** Carr, D.B.; Nicholson, W.L.; Cowley, P.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76RL01830. 8p. (CONF-8608125—2). NTIS, PC A02. File Number DE87002713.

From American Statistical Association meeting; Chicago, IL, USA (18 Aug 1986).

Exploratory data analysis is a discovery-driven process more suited to hindsight reorganization than to top-down design. Even complete archived records of an analysis can be very difficult to follow because the insights behind the apparent organizational madness are frequently missing, and because the records are usually organized by time rather than by objective. However, the recurrent resurrection of analyses, the increasing complexity of analyses and increased demands for quality assurance motivate the laying down of a meaningful, replicable record of the analysis process. To assist the data analyst in this process and in the process of keeping track of proliferating code and data, structures, a collection of data analysis management tools was envisioned. A prototype implementation of several tools, called ADAM, has undergone testing. The paper discusses both the envisioned tools and observations based on using and thinking about the prototype. 12 refs., 7 figs.

10658 **(SAND—86-1902) A coupled boundary integral and finite element formulation for nonlinear halfspace problems.** Stern, M.; Taylor, L.M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1986. Contract AC04-76DP00789. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87003594.

In many finite element applications involving static or quasistatic nonlinear inelastic response in halfspace regions, it is generally necessary to extend the mesh well beyond the region of interest so that whatever boundary conditions are imposed do not appreciably alter the effect of the stiffness of remote portions of the body. Alternatively, the boundary can be shrunk considerably if boundary forces which reflect the response of the exterior region to boundary displacement are imposed. We use an exterior halfspace boundary integral formulation to calculate a boundary stiffness matrix, which is then coupled to the finite element equations. This method is well suited to explicit finite element schemes such as the conjugate gradient and dynamic relaxation algorithms. The method is illustrated with examples. 5 refs., 24 figs.

10659 **(SAND—86-2398) Analysis of the receiving characteristics of the circular diffraction antenna with both a flush-mounted and a recessed center post.** Riley, D.J. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87003283.

A simplified model for analyzing the electromagnetic response of umbilical connectors and certain low-profile radar antennas is studied. The analysis is appropriate for approximating the response through several gigahertz. The integral equations which describe the TM symmetric modes are numerically solved, and several generic results are presented. Where applicable, comparison with analytic results is made. Corrections are made to some previous analytic results which have been found to be in error. 18 refs., 20 figs., 1 tab.

10660 **(SLAC—305) Network Communication Executive (NCX), programmer's guide.** Frese, H.; Streater, T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1986. Contract AC03-76SF00515. 35p. NTIS, PC A03. File Number DE87003584.

This manual describes the internal structure and function of the NETWORK COMMUNICATIONS EXECUTIVE (NCX) software. NCX runs in various environments, both hardware and software. This document describes the features that all versions of NCX have in common. It also presents the idiosyncrasies of the VM implementation of NCX. This docuement is intended for VM programmers who have a need for the facilities of NCX. It assumes the reader has experience programming is assembly language and in the C language.

10661 **(UCID—20927) Praxis release notes, versions 7.8.** Holloway, F.W.; Andersen, R.O.; Soto, C.S. (Lawrence Livermore National Lab., CA (USA)). 26 Nov 1986. Contract W-7405-ENG-48. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003296.

These release notes are intended as a guide to those responsible for Nova software and users of Praxis at other facilities. They assume previous knowledge of the Praxis language. All improvements and revisions made in this version of Praxis are described. The improvements made in version 7.8 of the compiler include: Comparison of Large Objects returned from Function, Extraction of Items from Constant Arrays to form other constants, Flexible arrays - Design Revisions, cleaned up unusual situations, Easier String Constructors - coercion, Set Implementation Extensions, Operating System (VMS) Interface Updates - RTLSTUBS, DEF files, Fixed some combinations of flexible arrays - may effect existing code, Minor Bug Fixes, Improved Diagnostics in some areas, and Symbols Declared/imported but Not Used are Flagged on Listings.

10662 **(UCRL—15847-Vol.5) Parameters and error of a theoretical model.** Moeller, P.; Nix, J.R.; Swiatecki, W. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). Sep 1986. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87002503.

We propose a definition for the error of a theoretical model of the type whose parameters are determined from adjustment to experimental data. By applying a standard statistical method, the maximum-likelihoodlmethod, we derive expressions for both the parameters of the theoretical model and its error. We investigate the derived equations by solving them for simulated experimental and theoretical quantities generated by use of random number generators. 2 refs., 4 tabs.

10663 **(WAPD-T—2885) Preconditioned polynomial iterative acceleration methods for block tridiagonal systems.** Abu-Shumays, I.K. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Sep 1986. Contract AC11-76PN00014. 51p. (CONF-861186—1). NTIS, PC A04/MF A01; GPO Dep. File Number DE87000901.

From Westinghouse engineering computer applications symposium; Monroeville, PA, USA (3 Nov 1986).

Preconditionings based on incomplete block odd-even cyclic reduction for Chebyshev and Conjugate Gradient polynomial iterative methods have been shown to be very effective for accelerating the convergence of the solution of linear systems which arise from discrete approximations of elliptic partial differential equations. The main contribution of this paper is to extend these methods to the important case of Red/Black partitioning of equations and unknowns and to demonstrate that a significant reduction in computations can be realized by applying preconditioned polynomial methods to the "reduced systems," which are obtained from the original systems by eliminating approximately half of the unknowns. This paper also compares the performance of several preconditioned polynomial methods for solving the two-dimensional diffusion equation on the CYBER 205 vector computer. The most effective methods tested are shown to be (1) the classical reduced system conjugate gradient method with preconditioner D/sub B/, the tridiagonal matrix associated with the black unknowns, and (2) the new reduced system conjugate gradient method with preconditioner based on incomplete block odd-even cyclic reduction. Of these methods, the latter is to be preferred for slow converging problems. 22 refs., 1 fig., 7 tabs.

10664 **The advantages of an adaptive multiprocessor architecture.** Maples, C.; Logan, D. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). pp 154-178 of New computing environments: Parallel, vector and systolic. Wouk, A. Philadelphia, PA; Society for Industrial and Applied Mathematics (1986). (CONF-8411140—). Contract AC03-76SF00098.

From ARO workshop on new computing environments: parallel, vector and systolic; Stanford, CA, USA (7 Nov 1984).

While there is considerable general agreement as to the importance and the potential of multiprocessor architectures, there is no consensus as to what the implementation of such systems means in actual practice. Issues such as specialized versus general purpose systems, global shared memory versus local memory, and the merits of different types of interconnection systems are still being debated. The answers to these questions are, of course frequently application dependent. The MIDAS Project, at the University of California's Lawrence Berkeley Laboratory, therefore provides an adaptive environment in which communication paths, control structures, and memory access requirements may easily be tailored to the needs of a specific problem. The presentation discusses the general architecture, together with different modes of operation (macroscopic data flow, circuit switched, master-slave) and the associated programming implications. The importance of system support for high-level performance analysis and debugging tools are also discussed with respect to experience on the current 11-processor MIDAS system. Extensibility of the architecture to hundreds or thousands of processors is examined.

10665 **Scientific applications and numerical algorithms on the midas multiprocessor system.** Logan, D.; Maples, C. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). pp 179-200 of New computing environments: Parallel, vector and systolic. Wouk, A. Philadelphia, PA; Society for Industrial and Applied Mathematics (1986). (CONF-8411140—). Contract AC03-76SF00098.

From ARO workshop on new computing environments: parallel, vector and systolic; Stanford, CA, USA (7 Nov 1984).

The MIDAS multiprocessor system is a multi-level, hierarchial structure designed at the Advanced Computer Architecture Laboratory of the University of California's Lawrence Berkeley Laboratory. A two-stage, 11-processor system has been operational for over a year and is currently undergoing expansion. It has been employed to investigate the performance of different methods of decomposing various problems and algorithms into a multiprocessor environment. The results of such tests on a variety of applications such as scientific data analysis, Monte Carlo calculations, and image processing, are discussed. Often such decompositions involve investigating the parallel structure of fundamental algorithms. Several basic algorithms dealing with random number generation, matrix diagonalization, fast Fourier transforms, and finite element methods in solving partial differential equations are also discussed. The performance and projected extensibilities of these decompositions on the MIDAS system are reported.

10666 **Multiple time scales.** Brackbill, J.U.; Cohen, B.I. Orlando, FL; Academic Press, Inc. (1985). 455p.

Various topics concerning multiple time scales are discussed. The subjects addressed include: considerations on solving problems with multiple scales, problems with different time scales, nonlinear normal mode initialization of numerical weather prediction models, diffusion synthetic acceleration of transport iterations with application to a radiation hydrodynamics problem, implicit methods in combustion and chemical kinetics modeling, implicit adaptive-grid radiation hydrodynamics, and multiple time-scale methods in Tokamak magnetohydrodynamics. Also covered are: hybrid and collisional implicit plasma simulation models, simulation of low-frequency electromagnetic phenomena in plasmas, orbit averaging and subcycling in particle simulation of plasmas, direct implicit plasma simulation, direct methods in N-body simulations, and molecular dynamics and Monte Carlo simulation of rare events.

9903 Information Handling

REFER ALSO TO CITATION(S) 10284

10667 (INDC(NDS)—179/G, pp 79-94) **Information on the REAL84 exercise.** Zijp, W.L.; Zsolnay, E.M.; Cullen, D.E. (Netherlands Energy Research Foundation, Petten; Budapesti Mueszaki Egyetem, Hungary; International Atomic Energy Agency, Vienna, Austria). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

This document gives information on the interlaboratory exercise REAL84. This exercise has as aim the improvement of the assessment of accuracies in radiation damage predictions by using good quality input data and proper calculation methods. In the exercise integral damage parameters (such as displacements per atom, or produced gas atoms) and spectrum characteristics are calculated for neutron spectra which are adjusted to fit experimental reaction rates obtained with activation spectrometry. The main difference with the preceding exercise REAL80 is that now improved information can be applied in the input data sets of the exercise. The improvement concerns mainly the availability of uncertainty information for the neutron spectrum and cross-section data. All parties interested are encouraged to participate in the exercise and to request from the IAEA the magnetic tape R84, which contains all input information. In order to meet the time schedule (see appendix) fast action is required. Refs, figs.

10668 (INDC(NDS)—179/G, pp 95-105) **Nuclear data aspects encountered in the REAL80 and REAL84 intercomparisons.** Nolthenius, H.J.; Zijp, W.L.; Zsolnay, E.M.; Szondi, E.J. (Netherlands Energy Research Foundation, Petten; Budapesti Mueszaki Egyetem, Hungary). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

A survey is presented of a number of nuclear data aspects encountered in the REAL80/REAL84 intercomparisons. The aim of the international interlaboratory REAL80 exercise was to determine the state of the art in 1981 to adjust neutron spectrum information, and subsequently predict the number of displacements. This exercise was hampered by lack of good nuclear data. At this moment improved data are available, which are applied in the input for the REAL84 exercise, which is started now. 4 refs, 6 tabs.

10669 (INDC(NDS)—179/G, pp 127-140) **Least-squares adjustment of a 'known' neutron spectrum: The importance of the covariance matrix of the input spectrum.** Mannhart, W. (Physikalisch-Technische Bundesanstalt, Braunschweig, Germany, F.R.). Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

Based on the responses of 25 different neutron activation detectors, the neutron spectrum of Cf-252 has been adjusted with least-squares methods. For a fixed input neutron spectrum, the covariance matrix of this spectrum has been systematically varied to investigate the influence of this matrix on the final result. The investigation showed that the adjusted neutron spectrum is rather sensitive to the structure of the covariance matrix for the input spectrum. 11 refs, 11 figs, 5 tabs.

10670 (INDC(NDS)—179/G, pp 157-183) **Uncertainty and correlation data for the ENDF/B-V dosimetry file (version 2).** Nolthenius, H.J.; Zijp, W.L. Jun 1986. NTIS (US Sales Only), PC A09/MF A01. File Number DE87700263. (CONF-8505321—).

From IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials; Santa Fe, NM, USA (20 May 1985).

This document presents a compilation of standard deviations and correlations for group cross-sections derived from TAPE531 version 2 of the ENDF/B-V. The group structure chosen for the presentation of the triangular matrices is the ABBN group structure, supplemented with a thermal group. 2 refs. The work has been carried out under contract to the European Commission and has been financed by JRC.

10671 (INIS-BR—540) **Development of a computer systems for operational data acquisition of uranium isotopic enrichment pilot plant.** Maia, W.M.C. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Engenharia Nuclear). Jan 1985. 82p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. File Number DE87700476.

A pilot plant for uranium enrichment using the jet nozzle process was transfered from Federal Republic of Germany to Brazil, to train Brazilian technicist in its operation and to improve the process. This pilot plant is monitored by a data acquisition system and the possibility of faulty events would cause serious dificulties, as far as maintenance is concerned (for instance, unvailable special components). It is described the development of a new system, which is proposed in order to minimize difficulties with maintenance that utilizes in the assembling integrated circuits of large scale of integration. It is controlled by a microcomputer.

10672 (INIS-mf—10515, pp 14-16) **Information base of Czechoslovak power system.** Linhart, F. (Vyzkumny Ustav Palivoenergetickeho Komplexu, Prague, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

In order to provide the systems research of the Czechoslovak power system it is necessary to acquire the most comprehensive possible information on home and foreign nuclear power sources. A list is given of some specifications of nuclear power plants with pressurized water reactors which it will be possible to obtain from the prepared data bank or from other information sources. (E.S.).

10673 (INIS-mf—10515, pp 19-22) **Conception of a data information system on nuclear power plant economics.** Hajicek, J. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The system being prepared will contain selected technical data on nuclear power plants, capital costs, number of workers needed for the construction of the plant, costs of electric power generation, number of operating personnel and costs of decommissioning the nuclear power plant. The data will be processed on a EC 1055 computer using the USS program package. The main source of data will be published literature. An experimental file with 120 entries has been processed and output forms were designed. (Ha).

10674 (INIS-mf—10515) **Meeting on the information needs of the Czechoslovak nuclear programme.** (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. 52p. (In Czech and Slovak). (CONF-8511236—). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477.

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The seminar was held on November 4 to 6, 1985 in Pisek. The participants heard 23 papers of which 18 were inputted in INIS. Experience was summed up with the use of the INIS and AGRIS databases, with the establishment and operation of terminal workplaces and with the provision of librarian services. (E.S.).

10675 (INIS-mf—10515, pp 23-24) **Development of the INIS system and Czechoslovak participation.** Pavlickova, J. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

A brief description is given of the current state and use of INIS, of the conclusions of working groups on the elaboration of a General Review of INIS Operations, and of Czechoslovak participation in the working groups. (J.P.).

10676 (INIS-mf—10515, pp 28-30) **Utilization of INIS data base and experience with online access.** Suk, B. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

A survey is given of services provided to users participating in the Czechoslovak nuclear programme, and of the number of SDI and retrospective searches processed in the period 1976 - 1st half of 1985. (J.P.).

10677 (INIS-mf—10515, pp 38-40) **Utilization of the INIS data base through the terminal station at the SKODA Plzen concern.** Beranova, E. (Skoda, Plzen, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The difficulties are surveyed which have been encountered in the establishment of the terminal station at SKODA Plzen, and experience with its use is outlined. (E.S.).

10678 (INIS-mf—10515, pp 41-44) **Nuclear science and technology information for metallurgical industry.** Skandera, B.; Madusiok, P. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra, Czechoslovakia. Informetal). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

Nuclear fields are represented in the metallurgical industry by tracer techniques used in the study of impurities in steel and by the development and production of materials for nuclear power engineering. Information is provided for these fields from the INIS data base and the Czechoslovak METAL data base. A comparison is made of the two bases and the accessibility is evaluated of primary documents. (E.S.).

10679 (INIS-mf—10515, pp 45-46) **Meeting the information needs of UJV.** Vymetal, L. (Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

Activities are described (documentation, librarian, reprographic) which provide information to staff of the Institute of Nuclear Research (UJV) and the Czechoslovak Atomic Energy Commission. (E.S.).

10680 (INIS-mf—10515, pp 47-48) **Information services provided by URVJT Kosice.** Koukolova, M.; Kovacova, A. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The provision of information for the implementation of projects involving the URVJT is discussed. Information services were upgraded by the establishment of a terminal station and the online use of the INIS data base. (E.S.).

10681 (INIS-mf—10515, pp 54-56) **Utilization of the AGRIS international system and its relation to INIS.** Slezakova, H. (Ustav Vedeckotechnickych Informaci pro Zemedelstvi, Prague, Czechoslovakia). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

Czechoslovakia's participation in the AGRIS system and the system's use by Czechoslovak experts is described. A second terminal station was set up in Nitra in order to improve the use of AGRIS. The possibility of using INIS by agricultural experts is being considered. (E.S.).

10682 (INIS-mf—10515, pp 60-62) **Centres of scientific, technical and economic information in newly established organizations.** Kleskenova, M. (Atomove Elektrarne, Mochovce, Czechoslovakia). 1985. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The establishment and development of the information centre operating within the Mochovce nuclear power plant are described. The centre operates librarian, documentation and publication services. (E.S.).

10683 (INIS-mf—10515, pp 63-64) **Current and future utilization of INIS by the Institute of Landscape Ecology of the Czechoslovak Academy of Sciences, Ceske Budejovice.** Landa, M.; Jarosik, J. (Ceskoslovenska Akademie Ved, Ceske Budejovice. Ustav Krajinne Ekologie). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The INIS system is currently used through the services of the Nuclear Information Centre in Prague. In 1986 a terminal will be put into operation which will be connected to the automated information systems used by the Czechoslovak Academy of Sciences. (E.S.).

10684 (INIS-mf—10515, pp 65-67) **Meeting the information needs for the development of science and technology in the Czechoslovak Uranium Industry Concern.** Tejml, V. (Ceskoslovensky Uranovy Prumysl, Pribram). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The organization is described of the information centre of the Czechoslovak uranium industry, and forms of meeting the information needs of scientific and technical staff. Cooperation is described with other information centres as are methods of publicizing results of scientific and technical development. (E.S.).

10685 (INIS-mf—10515, pp 5-6) **Information science and the Czechoslovak nuclear programme.** Panchatek, O. (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The article informs of the necessity of the information provision of the nuclear programme and of activities related to the project "Automation of information activity for the Czechoslovak nuclear programme". (E.S.).

10686 (INIS-mf—10515, pp 25-27) **Experience of NIC with establishment and experimental operation of terminal stations of Czechoslovak terminal network with access to IAEA data bases.** Blazek, J. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

A brief outline is given of the historical aspects of online access of the Nuclear Information Centre to the IAEA data bases and the problems connected with building a terminal network in Czechoslovakia. (J.P.).

10687 (INIS-mf—10515, pp 31-32) **Librarian services of NIC in INIS utilization.** Naprstkova, I. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The services provided by the microfiche library of the Nuclear Information Centre, loans of conventional materials from own stocks and through the interlibrary loaning service, and loans of technical films from the IAEA are discussed. (E.S.).

10688 (INIS-mf—10515, pp 33-34) **NIC publication activities.** Kyncl, J. (Ceskoslovenska Komise pro Atomovou Energii, Zbraslav nad Vltavou. Ustredni Informacni Stredisko pro Jaderny Program). 1985. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE87700477. (CONF-8511236—).

From Meeting on the information needs of the Czechoslovak nuclear programme - national seminar; Pisek, Czechoslovakia (4 Nov 1985).

The Nuclear Information Centre mainly publishes periodicals and non-periodical publications for the Czechoslovak Atomic Energy Commission. In case of free capacity it also prints periodicals published by institutions, institutes and organizations incorporated in the Czechoslovak nuclear programme. (E.S.).

10689 **(OEFZS-A—0886) INIS Descriptive Cataloguing Rules as a basic concept for the bibliographic registration of literature, written by members of the Austrian Research Centre Seibersdorf.** Ranz, F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Hauptabteilung Mathematik und Information). Oct 1986. 65p. (In German). (MI—87/86). Austrian Research Centre, A-2444 Seibersdorf, Austria.

Limited distribution.

The Austrian INIS-Centre is integrated in the main library of the Austrian Research Centre Seibersdorf (OEFZS). Besides the INIS-input the main library has the task to prepare an annual bibliography, which is published as a part of the Annual Report of the OEFZS. It includes all documents, written by members of the OEFZS in the course of one calender year as well as lectures, theses and dissertations. The concept for the bibliographic lists is based on the INIS Descriptive Cataloguing Rules. After a short description of the INIS-data fields the report gives a comparison between INIS-input and the OEFZS-internal bibliographic work. Practical considerations are emphasized.

9904 Law

10690 **(INIS-XN—25) Act 13/1986 of 14 April on the development and general co-ordination of scientific and technical research.** (International Atomic Energy Agency, Vienna (Austria)). 18 Apr 1986. 4p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. File Number DE87700304.

Published in Boletin Official del Estado No. 93.

The purpose of this Act is to set up new structures in Spain to encourage scientific and technological development. It provides for the establishment of a national plan for scientific research and technological development which must be approved by the Government before submission to Parliament. The Junta de Energia Nuclear is one of the public research organisations designated by the Act to collaborate in the implementation of the plan. It should be noted that in this respect the Junta will be renamed: Centro de Investigacion Energetica, Medio Ambiental y Technologica (Research Centre for Energy, Environment and Technology).

9905 Civilian Defense

10691 **(UCRL—15794-Rev.1) Magnitude and spatial distribution of urban flammable materials in the San Jose area, California: Final report.** Simonett, D.S.; Barrett, T.N.; Gopal, S.; Holsmuller, F.J.; Sun, G.; Veregin, H. (California Univ., Santa Barbara (USA). Dept. of Geography). Oct 1986. Contract W-7405-ENG-48. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87002758.

The distribution and quantity of combustible materials in urban areas is of prime importance for any study of fire spread and plume dynamics resulting from a nuclear attack. This study presents a methodology which uses aerial photographs and a sampling grid composed of 1000-foot cells to collect this information for San Jose and adjoining urban areas in California. A detailed literature search was carried out to obtain fuel loading estimates for the major building types in an urban environment. Due to the ambiguities in this literature, the values used in this study are approximations, but are supported by details of sources and assumptions. Some straightforward calculations using the results of the air photo interpretation and the literature search yielded information about fuel loading and other characteristics for each grid cell, including information on fire breaks, which are important features with respect to fire spread. The results yield an average preliminary and partial fuel loading of 9.2 kg/m^2. This value is somewhat lower than previous fuel loading estimates in the literature, which were obtained using different methodologies, and probably under-estimates the actual fuel loading in San Jose. Additional sources of fuel which remain to be accounted for, both in aggregate magnitude and expected burnable fractions, include asphalt of roofs, streets, sidewalks and parking lots, fuel storage facilities, fuel and natural gas in pipelines, natural vegetation, externally stored lumber, and construction, commercial and industrial-process materials. These additional sources could add as much as 4 kg/m^2 to the fuel loading, bringing our estimate into agreement with those of the most recent studies. Subsequent research will concentrate on an error analysis of the observed data, and on the feasibility of using Census or Landsat Thematic Mapper data to obtain fuel loading estimates.

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Research and development of hazardous/toxic-waste analytical screening procedures: available field methods for rapid screening of hazardous-waste materials at waste sites. Annual report, 12:9236 (R;US)

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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

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	12:10438	MLM—3398(OP)
AC04-76DP00613	**Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.**	
	12:9539	BDX—613-3625
	12:9676	BDX—613-3613
	12:9863	BDX—613-3615
AC04-76DP00789	**Sandia National Labs., Albuquerque, NM**	
	12:8869	(1986).
	12:8878	(1986).
	12:8893	(1986).
	Sandia National Labs., Albuquerque, NM (USA)	
	12:8899	SAND—86-1762
	Lawrence Berkeley Lab., CA (USA)	
	12:8985	SAND—85-7114
	New Mexico Univ., Albuquerque (USA). Dept. of Geology	
	12:8986	SAND—86-2192C

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	Sandia National Labs., Albuquerque, NM (USA)	
	12:9049	SAND—86-2396C
	12:9199	NUREG/CR—4512
	12:9200	NUREG/CR—4537
	12:9201	NUREG/CR—4563
	12:9207	SAND—86-1834C
	12:9208	SAND—86-1950C
	12:9209	SAND—86-1989C
	12:9210	SAND—86-2220C
	12:9211	SAND—86-2464C
	12:9212	SAND—86-2520C
	12:9213	SAND—86-2521C
	12:9214	SAND—86-2547C
	12:9215	SAND—86-2562C
	12:9346	DOE/DP/00789—T253
	12:9350	SAND—86-1418C
	12:9408	SAND—86-1359C
	12:9490	SAND—86-0531C
	12:9491	SAND—86-1395C
	12:9492	SAND—86-1402C
	Scofield (Jan P.), San Antonio, TX (USA)	
	12:9517	SAND—85-7258
	Sandia National Labs., Albuquerque, NM (USA)	
	12:9558	SAND—86-1966C
	12:9559	SAND—86-2426C
	12:9629	SAND—86-1136
	12:9630	SAND—86-1341C
	12:9640	SAND—86-1820
	12:9647	SAND—86-1307C
	12:9766	SAND—86-1582C
	Sandia National Labs., Livermore, CA (USA)	
	12:9874	SAND—86-8230
	Sandia National Labs., Albuquerque, NM (USA)	
	12:10109	SAND—86-0178C
	12:10110	SAND—86-2110
	Sandia National Labs., Livermore, CA (USA)	
	12:10580	SAND—86-8243
	Sandia National Labs., Albuquerque, NM (USA)	
	12:10658	SAND—86-1902
	12:10659	SAND—86-2398
AC04-76DR00789	**Sandia National Labs., Livermore, CA (USA)**	
	12:9056	SAND—86-8018
	12:9057	SAND—86-8249
AC04-78AL10751	**Bechtel National, Inc., San Francisco, CA (USA)**	
	12:8929	DOE/WIPP—86-012
AC05-76OR00001	**Goodyear Atomic Corp., Piketon, OH (USA). Technical Div.**	
	12:9634	GAT-T—3394
AC05-76OR00033	**Oak Ridge Associated Universities, Inc., TN (USA)**	
	12:10617	CONF-860586—4
AC05-84OR21400	**Oak Ridge National Lab., TN (USA)**	
	12:8907	ORNL/tr—86/59(1986).
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	12:9044	CONF-8610181—1
	12:9047	ORNL/M—258
	United Engineers and Constructors, Inc., Philadelphia, PA (USA)	
	12:9090	NUREG/CR—4764
	Oak Ridge National Lab., TN (USA)	
	12:9140	CONF-861185—1
	12:9156	ORNL—6324
	12:9157	ORNL/TM—10275
	12:9162	CONF-8610135—9
	12:9163	CONF-8610135—33
	12:9164	CONF-8610135—41
	Mark Technologies Corp., San Francisco, CA (USA)	
	12:9198	NUREG/CR—4306
	Oak Ridge National Lab., TN (USA)	
	12:9203	NUREG/CR—4697
	12:9204	ORNL—4169/V2/S2
	12:9205	ORNL/TM—10045
	12:9246	ORNL/PPA—86/2
	12:9276	ORNL/TM—10052
	12:9290	CONF-870101—3
	12:9311	CONF-8610169—1
	12:9359	CONF-861076—1
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	12:9412	Journal of Physical Chemistry 90 NO. 22. 5530-5535 (23 Oct 1986).
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	12:10045	CONF-861044—5
	12:10046	CONF-8610178—1
	12:10077	CONF-8610171—1
	Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy	
	12:10150	CONF-861114—30
	Oak Ridge National Lab., TN (USA)	
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	12:10284	CONF-861193—1
	12:10395	Nuclear Science and Engineering 94 NO. 1. 102-106 (Sep 1986).
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	Wisconsin Univ., Madison (USA)	
	12:10479	IAEA-CN—47/E-II-3-2
	Oak Ridge National Lab., TN (USA)	
	12:10524	ORNL/TM—10150
	12:10547	CONF-860914—13
	12:10548	CONF-860914—14
	12:10618	CONF-8609170—1
	Argonne National Lab., IL (USA)	
	12:10630	ANL/MCS-TM—86
	12:10635	CONF-860880—39
	Oak Ridge National Lab., TN (USA)	
	12:10636	CONF-8609173—3
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	12:8903	K/TR—86/14(1986).
	12:9014	K/HS—9
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	12:9616	K/PS—798
	12:9668	K/CSD/TM—65

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	12:10624	K/CSD/TM—60
AC05-86OR21600	**Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center**	
	12:8932	FMPC—2040
	12:9002	FMPC—2048
AC06-76FF02170	**Hanford Engineering Development Lab., P.O. Box 1970, Richland, WA**	
	12:9118	Fusion Technology 10 NO. 3. 405-410 (Nov 1986).
AC06-76RL01830	**Virginia Power Co., Richmond (USA)**	
	12:8910	EPRI-NP—4887
	Pacific Northwest Lab., Richland, WA (USA)	
	12:8920	PNL—5944
	USDOE Richland Operations Office, WA	
	12:8928	DOE/RL—86-10
	Pacific Northwest Lab., Richland, WA (USA)	
	12:8976	PNL-SA—13738
	12:8977	PNL-SA—13954
	12:8978	PNL-SA—14056
	12:8979	PNL-SA—14065
	12:8980	PNL-SA—14291
	12:8981	PNL-SA—14342
	12:8982	PNL-SA—14463
	12:8997	NUREG/CR—2675-Vol.6
	12:9008	PNL-SA—13389
	12:9020	PNL-SA—14371
	12:9021	PNL-SA—14402
	12:9048	PNL—5943
	12:9084	PNL—5955
	12:9123	NUREG/CR—4469-Vol.3
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	12:9232	PNL-SA—13506
	12:9305	PNL—5621
	12:9306	PNL—6064
	12:9316	PNL—5322-Exec.Summ.
	12:9322	PNL-SA—14018
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	12:10061	PNL-SA—13685
	12:10062	PNL-SA—14125
	12:10099	PNL-SA—13832
	12:10430	PNL-SA—13686
	12:10657	PNL-SA—14223
AC06-76RL01857	**UNC Nuclear Industries, Inc., Richland, WA (USA)**	
	12:9643	UNI—4091
AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
	12:8983	RHO-BW-SA—462P
	12:8984	RHO-HS-SR—85-1P
	12:8999	RHO-RE-SR—86-24P
AC06-81ER40048	**Washington Univ., Seattle (USA). Nuclear Physics Lab.**	
	12:10263	DOE/ER/40048—183
AC07-76ID01570	**Rice Univ., Houston, TX (USA)**	
	12:8871	EGG-M—24786
	EG and G Idaho, Inc., Idaho Falls (USA)	
	12:9098	GEND—057
	12:9121	EGG-M—13886
	12:9128	EGG-M—20986
	12:9154	NUREG/CR—4684-Vol.1
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	12:9167	EGG-M—14086
	12:9168	EGG-M—21486
	12:9169	EGG-M—21586
	12:9170	EGG-M—22086
	12:9171	EGG-M—22286
	12:9172	EGG-M—22486
	12:9173	EGG-M—22586
	12:9174	EGG-M—22786
	12:9175	EGG-M—23286
	12:9176	EGG-M—25686
	12:9177	EGG-M—34086
	12:9243	EGG-M—32886
	12:9678	EGG-M—11286
	12:10426	EGG-M—17986
	12:10553	EGG-M—30686
AC07-84ID12493	**Del Valle Hog Farm, TX (USA)**	
	12:9032	DOE/ID/12493—T1
AC07-85ID12578	**Eaton Operating Co., Inc., Houston, TX (USA)**	
	12:9074	DOE/ID/12578—T1
AC08-82DP40152	**KMS Fusion, Inc., Ann Arbor, MI (USA)**	
	12:10471	CONF-870108—2
	12:10565	KMSF-U—1754
AC08-83NV10270	**Science Applications International Corp., Las Vegas, NV (USA)**	
	12:10004	DOE/NV/10270—3
	12:10005	DOE/NV/10270—4
AC08-83NV10282	**EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations**	
	12:8890	EGG—10282-2123
	EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations	
	12:9001	EGG—10282-1129
	12:9910	EGG—10282-1117
	12:9911	EGG—10282-1126
	EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations	
	12:9927	EGG—10282-2124
	EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Aerial Measurements Operations	
	12:10047	EGG—10282-1130
	12:10082	EGG—10282-1125
	EG and G Energy Measurements, Inc., Suitland, MD (USA). Washington Aerial Measurements Dept.	
	12:10112	EGG—10282-1127
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	12:8930	DP-MS—86-48
	12:8931	DPST—83-652
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	12:9085	DPSP—84-1-1-Del.Ver.
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	12:9136	DPST—86-348
	12:9446	American Ceramic Society Bulletin 65 NO. 8. 1187-1190 (Aug 1986).
	12:9613	DPST—84-627
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	12:9899	CORR—84-00250
	Clemson Univ., SC (USA)	
	12:9982	CORR—86-00385
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	12:9984	DPST—85-404
	Environmental and Chemical Sciences, Inc., Aiken, SC (USA)	
	12:9999	DPST—85-790
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	12:10622	DP-MS—86-93
AC11-76PN00014	**Bettis Atomic Power Lab., West Mifflin, PA (USA)**	
	12:10663	WAPD-T—2885
AC20-84LC11049	**Wyoming Univ., Laramie (USA). Dept. of Civil Engineering**	
	12:9902	DOE/LC/11049—2205
AC21-84MC21315	**City Coll., New York (USA)**	
	12:8818	DOE/MC/21315—T2

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AC22-82PC50003	Air Products and Chemicals, Inc., Allentown, PA (USA)	12:8819	DOE/PC/50003—32
AC22-82PC50270	TRW Space and Technology Group, Redondo Beach, CA (USA)	12:8858	DOE/PC/50270—T13
		12:8859	DOE/PC/50270—T14
		12:8860	DOE/PC/50270—T15
AC22-83PC63032	TRW Space and Technology Group, Redondo Beach, CA (USA)	12:8809	DOE/PC/63032—T11
		12:8810	DOE/PC/63032—T12
		12:8811	DOE/PC/63032—T13
AC22-84PC70028	Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center	12:9033	DOE/PC/70028—T8
	Union Carbide Corp., Tarrytown, NY (USA). Catalysts and Services Div.	12:9034	DOE/PC/70028—T9
AC22-84PC70508	TRW, Inc., Cleveland, OH (USA)	12:9279	MHD-III—86-066
AC22-84PC72007	AMAX Extractive Research and Development Center, Golden, CO (USA)	12:8813	DOE/PC/72007—T10
AC22-85PC80023	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	12:8823	DOE/PC/80023—T6
AC22-85PC80753	IIT Research Inst., Chicago, IL (USA)	12:8814	DOE/PC/80753—T4
AC22-85PC81008	Tennessee Univ., Tullahoma (USA). Space Inst.	12:8852	DOE/PC/81008—T6
AC79-83BP11191	Portland General Electric Co., OR (USA)	12:9075	DOE/BP/11191—4
AI01-76ET20320	Paragon Pacific, Inc., Torrance, CA (USA)	12:9076	DOE/NASA—0247-3
AI01-85CE50112	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	12:9340	DOE/NASA/50112—67
AI08-76DP00474	Geological Survey, Denver, CO (USA)	12:10096	USGS-OFR—86-449
AI08-79DP40092	Naval Research Lab., Washington, DC (USA)	12:10573	NRL-MR—5892
AI79-83BP39830	Confederated Salish and Kootenai Tribes, Pablo, MT (USA)	12:9041	DOE/BP/39830—2
AM03-76SF00326	Lawrence Livermore National Lab., CA (USA)	12:10345	CONF-850507—68
AS03-76EV70134	California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics	12:9983	DOE/EV/70134—T10
AS03-76EV70190	California Univ., Berkeley (USA). Dept. of Biochemistry	12:10015	DOE/EV/70190—T2
AS03-80ER52061	California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering	12:10582	UCLA-ENG—86-38
AS05-76ER03948	Houston Univ., TX (USA). Dept. of Physics	12:10307	DOE/ER/03948—18
AS05-76ER04936	Oak Ridge Associated Universities, Inc., TN (USA)	12:10152	DOE/ER/04936—T2
AS05-79ER10494	Maryland Univ., College Park (USA). Dept. of Chemistry	12:10331	DOE/ER/10494—T2
AS05-80ER10635	Virginia Univ., Charlottesville (USA). Dept. of Chemistry	12:10153	DOE/ER/10635—4
AS05-81ER60006	Tennessee Univ., Knoxville (USA). Dept. of Chemistry	12:8851	DOE/ER/60006—5
AS05-82ER12088	Center for Energy and Environment Research, Mayaguez (Puerto Rico)	12:9543	DOE/ER/12088—12
AS05-83CE23858	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)	12:9293	DOE/CE/23858—1
		12:9294	DOE/CE/23858—T1
		12:9295	DOE/CE/23858—T3
AS05-84ER13147	Texas Univ., Austin (USA)	12:10443	DOE/ER/13147—2-Pt.7
AS08-84DP40207	California Univ., Davis (USA). Dept. of Applied Science	12:10550	DOE/DP/40207—1
AS08-85DP40205	California Univ., Los Angeles (USA). Dept. of Electrical Engineering	12:10549	DOE/DP/40205—1
AT01-77ER72027	National Bureau of Standards, Washington, DC (USA). Surface Science Div.	12:9545	DOE/ER/72027—T1
AT01-82ER12045	National Bureau of Standards, Boulder, CO (USA). Thermophysics Div.	12:9542	DOE/ER/12045—T1
AT02-81CH92127	Battelle Columbus Labs., OH (USA)	12:9425	BMI—2119
AT03-83ER40096	Stanford Univ., CA (USA). High-Energy Physics Lab.	12:9794	DOE/ER/40096—T1
AT06-76ER70005	Alaska Univ., Fairbanks (USA). Geophysical Inst.	12:10147	DOE/ER/70005—4
AT06-82ER60069	Washington Univ., Seattle (USA). School of Medicine	12:10014	DOE/ER/60069—T4
FC22-83FE60339	Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes	12:8807	DOE/FE/60339—T32
	Southern Illinois Univ., Carbondale (USA). Dept. of Geology	12:8808	DOE/FE/60339—T36
	Southern Illinois Univ., Carbondale (USA)	12:8816	DOE/FE/60339—T35
	Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes	12:8817	DOE/FE/60339—T41
	Southern Illinois Univ., Carbondale (USA). Dept. of Geology	12:8836	DOE/FE/60339—T30
	Southern Illinois Univ., Carbondale (USA). Dept. of Chemistry and Biochemistry	12:8837	DOE/FE/60339—T33
		12:8838	DOE/FE/60339—T44
	Southern Illinois Univ., Carbondale (USA). Dept. of Civil Engineering and Mechanics	12:8857	DOE/FE/60339—T43
	Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes	12:8862	DOE/FE/60339—T31
	Southern Illinois Univ., Carbondale (USA)	12:8863	DOE/FE/60339—T34
		12:8864	DOE/FE/60339—T39
	Southern Illinois Univ., Carbondale (USA). Dept. of Chemistry and Biochemistry	12:9546	DOE/FE/60339—T37
	Southern Illinois Univ., Carbondale (USA)	12:9547	DOE/FE/60339—T38
		12:9548	DOE/FE/60339—T40
FG01-85CE26525	Burns and Roe, Inc., Oradell, NJ (USA)	12:9320	DOE/CE/26525—T1
FG02-83NE44350	North Carolina Dept. of Natural Resources and Community Development, Raleigh (USA). Div. of Land Resources	12:8927	DOE/NE/44350—T1

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FG02-84ER13261	**Univ. of Nebraska, Lincoln**	
	12:9523	Journal of Physical Chemistry 90 NO. 23. 6071-6073 (6 Nov 1986).
FG02-84ER45141	**California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering**	
	12:9358	CONF-860340—11
FG02-85ER40211	**Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy**	
	12:10228	DOE/ER/40211—2
FG02-85ER45198	**Northwestern Univ., Evanston, IL (USA)**	
	12:9363	DOE/ER/45198—T2
FG02-85ER45222	**Boston Univ., MA (USA). Dept. of Physics**	
	12:10433	DOE/ER/45222—3
FG02-85ER60304	**Brown Univ., Providence, RI (USA). Dept. of Geological Sciences**	
	12:9885	DOE/ER/60304—2
FG02-86ER60401	**Illinois Univ., Urbana (USA)**	
	12:10031	DOE/ER/60401—2
FG03-84SF12186	**American Inst. of Architects Foundation, Washington, DC**	
	12:9296	DOE/SF/12186—T1
FG03-86ER13525	**California Univ., Irvine (USA). Dept. of Physiology and Biophysics**	
	12:10013	DOE/ER/13525—T1
FG05-84ER13285	**Florida Univ., Gainesville (USA). Database Systems Research and Development Center**	
	12:10634	CONF-851276—1
	12:10638	DOE/ER/13285—T1
FG05-85ER13339	**Meharry Medical Coll., Nashville (USA). Dept. of Biochemistry**	
	12:10012	DOE/ER/13339—2
FG05-85ER60301	**Maryland Univ., Frostburg (USA). Appalachian Environmental Lab.**	
	12:9955	CONF-8505326—1
	12:9957	DOE/ER/60301—1
FG05-86ER40273	**Florida State Univ., Tallahassee (USA). Dept. of Physics**	
	12:10266	DOE/ER/40273—1
FG05-86ER53221	**Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies**	
	12:10473	DOE/ER/53221—1
FG06-84ER60269	**Alaska Univ., Fairbanks (USA). Inst. of Marine Science**	
	12:9884	DOE/ER/60269—2
FG06-85ER25007	**Washington State Univ., Pullman (USA). Dept. of Pure and Applied Mathematics**	
	12:10639	DOE/ER/25007—1
FG06-86ER52125	**Washington Univ., Seattle (USA). Dept. of Nuclear Engineering**	
	12:9645	DOE/ER/52125—3
FG09-85ER60311	**Skidaway Inst. of Oceanography, Savannah, GA (USA)**	
	12:9958	DOE/ER/60311—2
FG22-81PC40782	**State Univ. of New York, Binghamton**	
	12:9574	Journal of the American Chemical Society 108 NO. 24. 7763-7767 (26 Nov 1986).
FG22-83PC60813	**Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering**	
	12:8820	DOE/PC/60813—13
FG22-84PC70006	**Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining**	
	12:8839	DOE/PC/70006—11
FG22-84PC70776	**California Univ., Berkeley (USA). Coll. of Engineering**	
	12:8812	DOE/PC/70776—T9
FG22-84PC70786	**State Univ. of New York, Binghamton (USA)**	
	12:8821	DOE/PC/70786—T7
FG22-84PC70798	**Utah Univ., Salt Lake City (USA). Biomaterials Profiling Center**	
	12:8840	DOE/PC/70798—T8

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FG22-84PC71257	**Pittsburgh Univ., PA (USA)**	
	12:8822	DOE/PC/71257—T8
FG22-85PC80508	**Yale Univ., New Haven, CT (USA). Dept. of Chemistry**	
	12:8841	DOE/PC/80508—3
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5354	NTIS (US Sales Only), PC A14/MF A01	DE87750721	MN -11	12:9937
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5357	NTIS (US Sales Only), PC A06/MF A01	DE87750740	MN -25	12:9357
5358	NTIS (US Sales Only), PC A04/MF A01	DE87750741	MN -41	12:9938
CEA-SERMA-				
29-T	NTIS (US Sales Only), PC A03/MF A01	DE87750713	MN -77	12:9107
CENBG-				
8524	NTIS (US Sales Only), PC A12/MF A01	DE87750754	MN -34C	12:10344
CEND-				
426	*See* DOE/ET/34013-12	E 1.99: DE87003624	STD -78	12:9095
CERIB-PT-				
80	NTIS (US Sales Only), PC A03; 3	DE87750415	MN -59B	12:9066
CERL-TR-M-				
86/ 16	*See* AD-A-172107/5/XAB			12:9318
CERL-TR-N-				
86/ 19	*See* AD-A-172105/9/XAB			12:9978
CERN-				
86-05	NTIS (US Sales Only), PC A14/MF A01	DE87700274	MN -22	12:9024
CERN-EP-				
86-137	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900141	MN -37	12:9793
86-142	NTIS (US Sales Only), PC A02/MF A01	DE87900143	MN -34D	12:10176
CNEA-NT-				
10/ 85	NTIS (US Sales Only), PC A04/MF A01	DE87700272	MN -41	12:9988
13/ 85	NTIS (US Sales Only), PC A04/MF A01	DE87700277	MN -28	12:9746
18/ 85	NTIS (US Sales Only), PC A02/MF A01	DE87700309	MN -32	12:10632
CNEN-DR-				
123/ 84	NTIS (US Sales Only), PC A04/MF A01	DE87700480	MN -32	12:10633
CONF-8212113-	(15. national seminar on nuclear magnetic resonance and its applications, Cracow, Poland, 1-2 Dec 1982) *See* INP-1206/PL	DE87780035	MN -34D	12:10457
CONF-8212114-	(Study meeting on radiation effect of insulation materials, Kumatori, Osaka, Japan, 13 Dec 1982) *See* KURRI-TR-247	DE87780041	MN -20c	12:9481
CONF-8308172-	(International symposium on mechanics of dislocations, Houghton, MI, USA, 28-31 Aug 1983)			
2	American Society for Metals, Metals Park, Ohio 44073	TI87002227	ND -25	12:9361
CONF-8311142-	(IAEA consultants meeting on nuclear data for borehole and bulk-media assay using nuclear techniques, Cracow, Poland, 14-18 Nov 1983)			
2	*See* INP-1222/AP	DE87700217	MN -51	12:9928
CONF-8311298-	(Meeting at KURRI on design of the facility for high flux and low temperature irradiations, Kumatori, Osaka, Japan, 2 Nov 1983) *See* KURRI-TR-249	DE87780042	MN -80	12:10421
CONF-840218-	(113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers, Los Angeles, CA, USA, 26 Feb-2 Mar 1984)			
9	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002535	MN -25	12:9348
CONF-8403250-	(AFME colloquium on meteorology and renewable energies, Valbonne, France, 18-23 Mar 1984)			
1	*See* CSTB-EN-CLI-84-9	DE87750436	MN -95	12:9882
CONF-840520-	(6. international conference on plasma surface interactions in controlled fusion devices, Nagoya, Japan, 14-18 May 1984)			
31	*See* LRP-237/84	DE87900198	MN -20a	12:10517

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CONF-8405218-	(ICFA seminar on future perspective in high energy physics, Tsukuba, Japan, 14-19 May 1984)			
	See KEK-84-14	DE87780049	MN -34D	12:10171
CONF-840616-	(International conference on plasma physics, Lausanne, Switzerland, 27 Jun-3 Jul 1984)			
25	*See* LRP-243/84	DE87900193	MN -20	12:10519
CONF-840757-	(22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984)			
41	*See* NUB-2664	TI87900315	MN -34D	12:10280
CONF-8407120-	(International symposium on gyrotron development, Lausanne, Switzerland, 4-6 Jul 1984)			
2	*See* LRP-247/84	DE87900206	MN -20	12:10570
CONF-8407189-	(US-Japan workshop on transport in open-ended systems, Nagoya, Japan, 30 Jul-3 Aug 1984)			
	See IPPJ-727	DE87780043	MN -20f	12:10513
CONF-8408209-	(Development of advanced technology for scientific research conference, Kumatori, Osaka, Japan, 7-8 Aug 1984)			
	See KURRI-TR-268	DE87780040	MN -80	12:9124
CONF-8409254-	(3. Joliot-Curie School on nuclear physics: mesons, baryons, quarks, Bombannes, France, 16-21 Sep 1984)			
	See IN2P3-84-01		ND -34	12:10232
CONF-8410450-	(Meeting of the working groups on neutron scattering applied to studying condensed matter, and neutron scattering and complementary methods applied in chemistry and biology, Maria Laach, F.R. Germany, 1-3 Oct 1984)			
	See Juel-Spez-316	DE87750303	MN -34C	12:10417
CONF-8411153-	(International conference on lasers '84, San Francisco, CA, USA, 26-30 Nov 1984)			
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002003	MN -34A	12:10151
CONF-8411277-	(Workshop on simulation techniques for shock wave phenomena and characteristics of plasmas in inertial confinement fusion, Nagoya, Japan, 15-16 Nov 1984)			
	See IPPJ-725	DE87780044	MN -21	12:10563
CONF-8411278-	(Toward unification and its verification workshop, Takayama, Gifu, Japan, 15-17 Nov 1984)			
	See KEK-85-4	DE87780045	MN -34D	12:10464
CONF-8411279-	(KEK international workshop on nuclear physics in GeV region, Oho, Ibaraki, Japan, 13-15 Nov 1984)			
	See KEK-84-20	DE87780048	MN -34C	12:10290
CONF-850157-	(Fusion Power Associates symposium on the search for attractive fusion concepts, La Jolla, CA, USA, 31 Jan-1 Feb 1985)			
	J. Fusion Energy, 5: No. 2, 135-154(Jun 1986)			12:10595
	J. Fusion Energy, 5: No. 2, 155-157(Jun 1986)			12:10596
	J. Fusion Energy, 5: No. 2, 125-134(Jun 1986)			12:10597
CONF-8501101-	(Symposium on research of semiconductors with research reactors, Kumatori, Osaka, Japan, 21-22 Jan 1985)			
	See KURRI-TR-263	DE87700246	MN -34A	12:9483
CONF-850210-	(12. annual WATTec energy conference and exhibition, Knoxville, TN, USA, 12-15 Feb 1985)			
5	*See* K/OA-5826	E 1.99: DE87002803	MN -15	12:9015
CONF-8502142-	(Workshop on scope and technical application of neutron activation analysis, Bangi, Selangor, Malaysia, 5-6 Feb 1985)			
	See PPA-BEN-3	DE87780031	MN -4	12:9516
CONF-8503151-	(International symposium on physics of proton-antiproton collision, Tsukuba, Japan, 13-15 Mar 1985)			
	See KEK-85-5	DE87780046	MN -34D	12:10172
CONF-8503265-	(Workshop on future plans for high energy physics, Oho, Ibaraki, Japan, 25-26 Mar 1985)			
	See KEK-85-6	DE87780047	MN -34D	12:10173
CONF-850476-	(Symposium on lasers and particle beams for fusion and strategic defense, Rochester, NY, USA, 18-19 Apr 1985)			
	J. Fusion Energy, 5: No. 1, 77-84(Mar 1986)			12:10598
	J. Fusion Energy, 5: 85-95(Mar 1986)			12:10599
	J. Fusion Energy, 5: No. 1, 51-56(Mar 1986)			12:10600
	J. Fusion Energy, 5: No. 1, 33-40(Mar 1986)			12:10601
	J. Fusion Energy, 5: No. 1, 17-22(Mar 1986)			12:10602
	J. Fusion Energy, 5: No. 1, 65-76(Mar 1986)			12:10603
	J. Fusion Energy, 5: No. 1, 57-64(Mar 1986)			12:10604
	J. Fusion Energy, 5: No. 1, 23-32(Mar 1986)			12:10605
CONF-8504220-	(18. informal noise meeting, Prague, Czechoslovakia, 10-12 Apr 1985)			
1	*See* ENEA-RT-TIB-86/7	DE87900285	MN -79	12:9114
CONF-8504277-	(International symposium on systems with fast ion transport, Smolenice, Czechoslovakia, 1-4 Apr 1985)			
	See INIS-mf-10511	DE87780030	MN -4	12:9505

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CONF-850507-	(International conference on nuclear data for basic and applied science, Santa Fe, NM, USA, 13-17 May 1985)			
68	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003162	MN -34C	12:10345
CONF-8505321-	(IAEA consultants' meeting on nuclear data for radiation damage estimates for reactor structural materials, Santa Fe, NM, USA, 20-22 May 1985)			
	See INDC(NDS)-179/G	DE87700263	MN -25	12:9366
CONF-8505326-	(Chaparral ecosystems research conference, Santa Barbara, CA, USA, 16-17 May 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002874	MN -11	12:9955
CONF-8505327-	(ARO meeting on workstations and supercomputing, Newark, DE, USA, 1 May 1985)			
1	*See* LA-UR-86-3771	E 1.99: DE87002921	MN -32	12:10654
CONF-850609-	(25. annual international conference of the Canadian Nuclear Association and 6. annual conference of the Canadian Nuclear Society, Ottawa, Ontario, Canada, 2-5 Jun 1985)			
9	*See* AECL-8774	DE87700283	MN -80	12:9110
10	*See* AECL-8841	DE87700286	MN -80	12:9139
CONF-8506120-	(4. international conference on nuclear reaction mechanisms, Varenna, Italy, 10-15 Jun 1985)			
2	*See* IPNO-DRE-85-13	DE87750734	MN -34C	12:10324
CONF-8506197-	(Workshop on elastic and diffractive scattering at the collider, Chateau de Blois, France, 3-6 Jun 1985)			
7	*See* IPNO-TH-85-46	DE87750777	MN -34D	12:10240
8	*See* IPNO-TH-85-47	DE87750778	MN -34D	12:10183
CONF-8506318-	(European workshop on investigation of strong motion processing procedures, Roma, Italy, 26-28 Jun 1985)			
EXC.	*See* CEA-CONF-8380	DE87750714	MN -11	12:10097
CONF-850713-	(International conference on nuclear power plant aging, availability factor and reliability analysis, San Diego, CA, USA, 7-12 Jul 1985)			
13	*See* CEA-CONF-8376	DE87750261	MN -78	12:9094
CONF-850765-	(26. annual meeting of the Institute of Nuclear Materials Management, Albuquerque, NM, USA, 21-24 Jul 1985)			
43	*See* AECL-8855	DE87700478	MN -16	12:9009
44	*See* AECL-8856	DE87700479	MN -16	12:9010
CONF-850771-	(SLAC summer school on the physics of high energy particle accelerators, Stanford, CA, USA, 15-26 Jul 1985)			
8	*See* BNL-38824	E 1.99: DE87002392	MN -28	12:9743
CONF-850806-	(Course and workshop on basic physical processes in fusion plasmas, Varenna, Italy, 26 Aug-3 Sep 1985)			
5	*See* LRP-276/85	DE87900188	MN -20	12:10522
CONF-850861-	(11. International Association of Mathematics and Computers Simulation world congress, Oslo, Norway, 5-9 Aug 1985)			
4	*See* CEA-CONF-8244	DE87750712	MN -4	12:9607
CONF-8508117-	(14. international colloquium on group theoretical methods in physics, Seoul, Korea, 26-30 Aug 1985)			
5-Summ.	*See* LYCEN-8555	DE87750760	MN -34	12:10466
CONF-8508180-	(4. annual meeting of the Society of Magnetic Resonance in Medicine, London, UK, 19-23 Aug 1985)			
1	*See* CEA-CONF-8350	DE87750270	MN -48	12:10030
CONF-8508207-	(Symposium on path integrals from meV to Mev, Zif-Bielefeld, F.R. Germany, 5-9 Aug 1985)			
1	*See* CEA-CONF-8245	DE87750256	MN -34D	12:10442
CONF-850914-	(Phase space approach to nuclear dynamics meeting, Miramare, Trieste, Italy, 30 Sep-4 Oct 1985)			
4	*See* IPNO-TH-85-52	DE87750729	MN -34C	12:10368
CONF-850927-	(12. European conference on controlled fusion and plasma physics, Budapest, Hungary, 2-6 Sep 1985)			
10	*See* LRP-272/85	DE87900189	MN -20g	12:10521
CONF-850981-	(International symposium on coupled processes affecting the performance of a nuclear waste repository, Berkeley, CA, USA, 18-20 Sep 1985)			
9	*See* RHO-BW-SA-462P	E 1.99: DE87003150	MN -70	12:8983
CONF-8509147-	(ACTINIDES '85, Aix-en-Provence, France, 1-6 Sep 1985)			
27	*See* CEA-CONF-8392	DE87750717	MN -4	12:9611
CONF-8509192-	(Course and workshop on applications of RF waves to tokamak devices, Varenna, Italy, 5-14 Sep 1985)			
7	*See* LRP-277/85	DE87900187	MN -20	12:10571
CONF-8509203-	(International conference on dimensions and entropies in chaotic systems, Pecos River, NM, USA, 11-16 Sep 1985)			
9	*See* DOE/ER/13147-2-Pt.7	E 1.99: DE87000763	MN -34	12:10443
CONF-8509227-	(IAEA topical meeting on phase space approach to nuclear dynamics, Trieste, Italy, 30 Sep-4 Oct 1985)			
8	*See* IPNO-TH-85-49	DE87750757	MN -34C	12:10367

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
CONF-8509231-	(Microphysical reality and quantum formalism, Urbino, Italy, 25 Sep-3 Oct 1985)			
2	*See* IPNO-DRE-86-03	DE87750779	MN -34D	12:10460
CONF-8509330-	(CERN accelerator school, Oxford, UK, 16-27 Sep 1985)			
3	*See* LAL-RT-86-02	DE87750746	MN -28	12:9734
CONF-8509343-	(La Jolla physics symposium, San Diego, CA, USA, 6-8 Sep 1985)			
1	*See* UCRL-95478	E 1.99: DE87000500	MN -21	12:10586
CONF-8510160-	(ASM metals congress/TMS-AIME fall meeting, Toronto, Ontario, Canada, 13-18 Oct 1985)			
20	*See* BNL-38541	E 1.99: DE87001369	MN -25	12:9353
CONF-8510315-	(2. international symposium on NCT, Tokyo, Japan, 1 Oct 1985)			
3	*See* BNL-37361	E 1.99: DE87003225	MN -48	12:10027
CONF-8510384-	(5. national seminar on creep and creep fracture, Kuparovice, Czechoslovakia, 21-24 Oct 1985)			
Pt.1	*See* INIS-mf-10516	DE87700261	MN -25	12:9377
Pt.2	*See* INIS-mf-10517	DE87780056	MN -25	12:9381
CONF-851128-	(17. European conference on laser interaction with matter, Rome, Italy, 18-22 Nov 1985)			
3	*See* CEA-CONF-8267	DE87750262	MN -20	12:10470
CONF-8511163-	(4. Amsterdam miniconference, Amsterdam, Netherlands, 26 Nov 1985)			
2	*See* CEA-CONF-8304	DE87750038	MN -34C	12:10356
CONF-8511236-	(Meeting on the information needs of the Czechoslovak nuclear programme - national seminar, Pisek, Czechoslovakia, 4-6 Nov 1985)			
	See INIS-mf-10515	DE87700477	MN -2	12:10674
CONF-851276-	(1. annual international conference on supercomputing systems, St. Petersburg, FL, USA, 16-20 Dec 1985)			
1	NTIS, PC A02; 3	DE87002498	MN -32	12:10634
CONF-851299-	(Workshop on 4.... physics, Grenoble, France, 16-18 Dec 1985)			
1-Summ.	*See* IPNO-TH-86-10	DE87750730	MN -34C	12:10370
2-Summ.	*See* CEA-CONF-8363	DE87750759	MN -34C	12:10283
CONF-8512105-	(Lecture meeting on environmental chemicals - their impacts and pathways, Bonn, F.R. Germany, 12-13 Dec 1985)			
	NTIS (US Sales Only), PC A05/MF A01; 1	DE87750805	MN -41	12:9895
CONF-860102-	(3. symposium on space nuclear power systems, Albuquerque, NM, USA, 13-16 Jan 1986)			
13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86014603	MN -93A	12:9281
CONF-860106-	(ASHRAE semi-annual meeting, San Francisco, CA, USA, 19-22 Jan 1986)			
	ASHRAE Trans., 92: No. 1B, 631-639(1986)			12:8848
CONF-860146-	(Radiobioassay and internal dosimetry workshop, Albuquerque, NM, USA, 20 Jan 1986)			
13	*See* PNL-SA-13686	E 1.99: DE87002715	MN -41	12:10430
14	*See* PNL-SA-13685	E 1.99: DE87002710	MN -41	12:10061
CONF-860158-	(25. international meeting on nuclear physics, Bormio, Italy, 20-25 Jan 1986)			
4	*See* CEA-CONF-8322	DE87750707	MN -34C	12:10357
5	*See* IPNO-DRE-86-01	DE87750786	MN -34C	12:10320
CONF-860340-	(115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting, New Orleans, LA, USA, 2-6 Mar 1986)			
11	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002075	MN -25	12:9358
CONF-8603109-	(4. European symposium on semiconductor detectors, Munich, F.R. Germany, 3-5 Mar 1986)			
6	*See* MPI-PAE/Exp.El.-164	DE87750316	MN -37	12:9833
CONF-8603118-	(21. Recontre de Moriond: perspectives in electroweak interactions and unified theories, Les Arcs, France, 9-16 Mar 1986)			
7	*See* KFK-4110	DE87750317	MN -34D	12:10217
CONF-8603119-	(21. Rencontre de Moriond: strong interactions and gauge theories conference, Les Arcs, France, 16-22 Mar 1986)			
12	*See* CEA-CONF-8467	DE87750775	MN -34D	12:10265
CONF-8603145-	(International conference on a European hadron facility, Mainz, F.R. Germany, 10-14 Mar 1986)			
3	*See* INFN/AE-86/7	DE87900279	MN -28	12:9707
CONF-8603158-	(IAEA expert meeting on spent fuel management, Vienna, Austria, 10-14 Mar 1986)			
1	*See* CEA-CONF-8367	DE87750718	MN -86	12:8905
CONF-860412-	(13. European conference on controlled fusion and plasma heating, Schliersee, F.R. Germany, 14-18 Apr 1986)			
15	*See* LRP-287/86	DE87900204	MN -20	12:10523
CONF-860421-	(2. international conference on fusion reactor materials (ICFRM-2), Chicago, IL, USA, 13-17 Apr 1986)			
67	*See* CEA-CONF-8410	DE87750787	MN -20d	12:10544

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CONF-8604185-	(2. symposium on analytic techniques for energy, natural resources, and environmental planning, Philadelphia, PA, USA, 3-4 Apr 1986)			
2	*See* PNL-SA-13506	DE87002714	MN -98	12:9232
CONF-8604261-	(AIEA technical meeting, Rome, Italy, 14-18 Apr 1986)			
1	*See* CEA-CONF-8417	DE87750240	MN -70	12:8925
CONF-8604262-	(16. meeting on actinides, Eibsee, F.R. Germany, 28-30 Apr 1986)			
1-Summ.	*See* CEA-CONF-8457	DE87750241	MN -25	12:9612
CONF-8604272-	(Congress on ESR of radicals in organic and bio-organic systems, Leeds, UK, 14-18 Apr 1986)			
1	*See* CEA-CONF-8458	DE87750742	MN -48	12:10044
CONF-8604282-	(Quark matter '86, Asilomar, CA, USA, 1 Apr 1986)			
1	*See* FNAL/C-86/115	E 1.99: DE87002077	MN -34D	12:10178
CONF-860510-	(Symposium on heavy ion inertial fusion, Washington, DC, USA, 27-29 May 1986)			
18	*See* GSI-86-27-Prepr.	DE87750318	MN -28	12:9706
19	*See* UCRL-94346	E 1.99: DE87003159	MN -21	12:10583
CONF-860522-	(7. international conference on plasma surface interactions in controlled fusion devices, Princeton, NJ, USA, 5-9 May 1986)			
21	*See* PPPL-2393	E 1.99: DE87003071	STD -20a	12:10530
CONF-860570-	(INFN Eloisatron Project: seminar on new techniques for future accelerators, Erice, Trapani, Italy, 11-17 May 1986)			
2	*See* BNL-38947	E 1.99: DE87003201	MN -28	12:9704
CONF-860586-	(World conference on continuing education, Lake Buena Vista, FL, USA, 7-9 May 1986)			
4	Inst. of Electr. and Electronics Eng., Inc., 345 E.47th St., New York, NY 10017	TI87000313	ND -13	12:10617
CONF-8605199-	(6. CNLS annual conference on nonlinearities in condensed matter, Los Alamos, NM, USA, 4-9 May 1986)			
3	*See* DOE/ER/45222-3	DE87000986	MN -34A	12:10433
4	*See* LA-UR-86-3847	E 1.99: DE87002908	MN -34	12:10441
5	*See* LA-UR-86-3819	E 1.99: DE87002912	MN -34	12:10436
7	*See* LA-UR-86-3820	E 1.99: DE87002911	MN -34	12:10437
8	*See* LA-UR-86-3844	E 1.99: DE87002909	MN -34	12:10168
CONF-8605211-	(2. Latin American congress on heat and mass transfer, San Paulo, Brazil, 12-15 May 1986)			
1	*See* ENEA-RT-TERM-86/4	DE87900295	MN -78	12:9178
CONF-860601-	(4. international conference on emerging nuclear energy systems, Madrid, Spain, 30 Jun-4 Jul 1986)			
11-Rev.1	*See* UCRL-95125-Rev.1	E 1.99: DE87002378	MN -34C	12:10469
CONF-860610-	(American Nuclear Society annual meeting, Reno, NV, USA, 15-20 Jun 1986)			
37	NTIS, PC A02; 3	DE87002139	MN -20d	12:10546
CONF-860629-	(Linear accelerator conference, Stanford, CA, USA, 2-6 Jun 1986)			
60	*See* CEA-CONF-8444	DE87750715	MN -28	12:9728
CONF-860650-	(NATO advanced study institute on techniques and concepts of high energy physics, St. Croix, Virgin Islands, U.S., 19-30 Jun 1986)			
1	*See* SLAC-PUB-4073	E 1.99: DE87002995	MN -28	12:9737
CONF-8606111-	(6. international symposium on radiopharmaceutical chemistry, Boston, MA, USA, 29 Jun-3 Jul 1986)			
4	*See* DOE/ER/60401-2	E 1.99: DE87001928	MN -48	12:10031
CONF-8606130-	(International conference on nuclear structure, reactions, and symmetries, Dubrovnik, Yugoslavia, 5-14 Jun 1986)			
9	*See* GSI-86-24-Prepr.	DE87750306	MN -34A	12:10155
10	*See* GSI-86-29-Prepr.	DE87750319	MN -34C	12:10340
CONF-8606139-	(Health Physics Society meeting, Pittsburgh, PA, USA, 29 Jun-3 Jul 1986)			
1	*See* PNL-SA-13609	E 1.99: DE86012331	MN -41	12:10060
9	*See* EGG-M-17986	E 1.99: DE87001441	MN -41	12:10426
CONF-8606150-	(8. international symposium on pteridines and folic acid derivatives, Montreal, Canada, 14-21 Jun 1986)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002626	MN -48	12:10011
CONF-8606151-	(76. annual meeting of the Federation of American Society for Experimental Biology, Washington, DC, USA, 8-12 Jun 1986)			
	Fed. Proc., Fed. Am. Soc. Exp. Biol., 45: No. 6, 1840(May 1986)			12:10024
CONF-8606203-	(Symposium on multiparticle dynamics, Seewinkel, Austria, 13-23 Jun 1986)			
8	*See* ANL-HEP-CP-86-94	E 1.99: DE87001555	MN -34D	12:10175
CONF-8606215-	(Summer study on the physics of the superconducting super collider, Snowmass, CO, USA, 23 Jun-11 Jul 1986)			
18	*See* SLAC-PUB-4130	DE87003259	MN -37	12:9847
19	*See* LA-UR-86-3980	E 1.99: DE87002899	MN -34B	12:10389

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CONF-8606228-	(International seminar on local approach of rupture, Moret-sur-Loing, France, 3-5 Jun 1986)			
1	*See* CEA-CONF-8445	DE87750762	MN -25	12:9355
CONF-8606229-	(3. workshop on radiations chemistry, Autrans, France, 10-13 Jun 1986)			
1	*See* CEA-CONF-8485	DE87750774	MN -4	12:9608
CONF-8606239-	(Symposium on pattern recognition methods in analytical spectroscopy, Snowbird, UT, USA, 16-18 Jun 1986)			
1	*See* UCRL-95387	E 1.99: DE87002376	MN -4	12:9518
CONF-8606240-	(3. Pisa meeting on advanced detectors, Pescaia, Italy, 2-7 Jun 1986)			
1	*See* CERN-EP-86-137	DE87900141	MN -37	12:9793
CONF-8606241-	(3. Continuous Electron Beam Accelerator Facility summer school, Newport News, VA, USA, 23-27 Jun 1986)			
1	*See* UCRL-95365	E 1.99: DE87000599	MN -34C	12:10304
CONF-860701-	(23. international conference on high-energy physics, Berkeley, CA, USA, 16-23 Jul 1986)			
53	*See* CERN-EP-86-142	DE87900143	MN -34D	12:10176
59	*See* SLAC-PUB-4070	E 1.99: DE87003272	MN -34D	12:10281
60	*See* SLAC-PUB-4018	E 1.99: DE87003270	MN -34D	12:10260
61	*See* SLAC-PUB-4102	E 1.99: DE87003278	MN -28	12:10221
62	*See* SLAC-PUB-4064	DE87003276	MN -28	12:9841
63	*See* SLAC-PUB-4055	DE87003273	MN -34D	12:10220
64	*See* LA-UR-86-3789	E 1.99: DE87002916	MN -34B	12:10388
CONF-860703-	(4. international conference on megagauss magnetic-field generation and related topics, Santa Fe, NM, USA, 14-17 Jul 1986)			
33	*See* LA-UR-86-4048	E 1.99: DE87002891	MN -45	12:9873
CONF-860736-	(SLAC summer institute on particle physics, Stanford, CA, USA, 29 Jul-9 Aug 1986)			
6	*See* SLAC-PUB-4140	E 1.99: DE87003265	MN -34D	12:10261
CONF-860741-	(International symposium on weak and electromagnetic interactions in nuclei, Heidelberg, F.R. Germany, 1-5 Jul 1986)			
21	*See* TRI-PP-86-64	DE87900171	MN -34C	12:10321
CONF-860746-	(Anomalous rare earths and actinides, Grenoble, France, 7-11 Jul 1986)			
9	*See* CEA-CONF-8471	DE87750772	MN -34	12:10431
13	*See* LBL-21790	E 1.99: DE87002566	MN -25	12:9401
CONF-860793-	(2. IAP recontre on nuclear astrophysics, Paris, France, 7-11 Jul 1986)			
1	*See* UCRL-95416	E 1.99: DE87000602	MN -34B	12:10136
3	*See* UCRL-95417	E 1.99: DE87003250	MN -34B	12:10137
CONF-860794-	(Nonlinear analysis and applications, Arlington, TX, USA, 28 Jul-1 Aug 1986)			
1	*See* LA-UR-86-3400	E 1.99: DE87001956	MN -32	12:10653
CONF-860796-	(International symposium on metal speciation, separation and recovery, Chicago, IL, USA, 27 Jul-1 Aug 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001530	MN -4	12:9500
CONF-860797-	(Conference on physico-chemical hydrodynamic instabilities, La Rabida, Spain, 11-16 Jul 1986)			
1	*See* LA-UR-86-3855	E 1.99: DE87002906	MN -32	12:10655
CONF-860802-	(International nuclear physics conference, Harrogate, UK, 25-30 Aug 1986)			
11	*See* LA-UR-86-3860	E 1.99: DE87002904	MN -34C	12:10313
CONF-860806-	(8. international conference on solid state dosimetry, Oxford, UK, 26-29 Aug 1986)			
2	*See* DOE/ER/52125-3	E 1.99: DE87003138	MN -38	12:9645
CONF-860818-	(American Council for an Energy Efficient Economy Santa Cruz summer study on energy-efficiency in buildings, Santa Cruz, CA, USA, 17-23 Aug 1986)			
13	*See* PNL-SA-14018	E 1.99: DE87003171	MN -95	12:9322
CONF-860826-	(National meeting of the American Institute of Chemical Engineers, Boston, MA, USA, 24-27 Aug 1986)			
10	*See* SERI/TP-231-3023	E 1.99: DE87001121	MN -61E	12:9037
CONF-860856-	(Conference on review of progress in quantitative NDE, San Diego, CA, USA, 3-8 Aug 1986)			
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001525	MN -25	12:9677
9	*See* EGG-M-11286	E 1.99: DE87000440	MN -38	12:9678
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001484	MN -25	12:9450
CONF-860870-	(13. international conference on high energy accelerators, Novosibirsk, USSR, 7-11 Aug 1986)			
15	*See* FNAL/C-86/124	E 1.99: DE87002213	MN -28	12:9748
16	*See* TRI-PP-86-69	DE87900097	MN -28	12:9768
17	*See* BNL-38812	E 1.99: DE87002581	MN -28	12:9702
CONF-860880-	(30. SPIE technical symposium on optics and optoelectronic engineering, San Diego, CA, USA, 17-22 Aug 1986)			
39	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001524	MN -32	12:10635
40	*See* GA-A-18517	E 1.99: DE87002934	MN -20	12:10554

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CONF-8608123-	(Advanced accelerator concepts conference, Madison, WI, USA, 21-27 Aug 1986)			
5	*See* LA-UR-86-3760	E 1.99: DE87002925	MN -28	12:9722
6	*See* LA-UR-86-3761	E 1.99: DE87002924	MN -28	12:9733
7	*See* SLAC-PUB-4111	E 1.99: DE87003262	MN -28	12:9767
8-Rev.	*See* SLAC-PUB-4042-Rev.	E 1.99: DE87003274	MN -28	12:9725
9	*See* BNL-38917	E 1.99: DE87003204	MN -28	12:9703
CONF-8608125-	(American Statistical Association meeting, Chicago, IL, USA, 18-21 Aug 1986)			
2	*See* PNL-SA-14223	DE87002713	MN -32	12:10657
CONF-8608136-	(Society of Automotive Engineers conference, Los Angeles, CA, USA, 4-7 Aug 1986)			
1	NTIS, PC A02; 3	DE87001519	MN -96	12:9341
CONF-8608138-	(24. course of the international school of subnuclear physics on the super world, Erice, Italy, 7-15 Aug 1986)			
1	*See* LA-UR-86-3533	E 1.99: DE87001952	MN -34D	12:10256
CONF-860902-	(Course and workshop on basic and advanced fusion plasma diagnostic techniques, Varenna, Italy, 3-13 Sep 1986)			
3	*See* UCRL-94784	E 1.99: DE87002759	MN -21	12:10584
CONF-860905-	(International meeting on low, intermediate and high level waste management - decontamination and decommissioning, Niagara Falls, NY, USA, 14-18 Sep 1986)			
22	*See* DP-MS-86-48	E 1.99: DE87002639	MN -70	12:8930
25	*See* PNL-SA-13954	E 1.99: DE87003406	MN -70	12:8977
CONF-860909-	(Conference on the treatment and containment of radioactive wastes and disposal in arid environments (Radwaste '86), Cape Town, South Africa, 7-13 Sep 1986)			
Absts.	*See* INIS-mf-10514	DE87700294	MN -70	12:8950
CONF-860911-	(192. American Chemical Society national meeting, Anaheim, CA, USA, 7-12 Sep 1986)			
20	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002421	MN -4	12:9501
21	*See* SAND-86-1966C	E 1.99: DE87002492	MN -4	12:9558
23	*See* SAND-86-2562C	E 1.99: DE87002485	MN -78	12:9215
CONF-860914-	(Applied superconductivity conference (ASC '86), Baltimore, MD, USA, 28 Sep-4 Oct 1986)			
13	NTIS, PC A02; 3	DE87002189	MN -20b	12:10547
14	NTIS, PC A02; 3	DE87001830	MN -20b	12:10548
15	*See* LBL-21297	E 1.99: DE87002572	MN -28	12:9764
16	*See* LBL-21292	E 1.99: DE87002547	MN -28	12:9735
17	*See* LBL-21230	DE87002571	MN -28	12:9763
19	*See* BNL-38856	E 1.99: DE87003211	MN -28	12:9744
CONF-860917-	(14. SOFT - symposium on fusion technology, Avignon, France, 8-12 Sep 1986)			
10	*See* DOE/ET/51013-196	E 1.99: DE87002771	MN -20b	12:10552
11	*See* DOE/ET/51013-195	E 1.99: DE87002770	MN -20	12:10551
CONF-860921-	(ISEC '86: international solvent extraction conference, Munich, F.R. Germany, 11-16 Sep 1986)			
5	*See* CEA-CONF-8402	DE87750716	MN -86	12:8906
CONF-860931-	(International conference on reliable fuels for liquid metal reactors, Tucson, AZ, USA, 7-11 Sep 1986)			
3	*See* CEA-CONF-8452	DE87750273	MN -79	12:9112
CONF-860943-	(6. physics in collision, Chicago, IL, USA, 3-5 Sep 1986)			
1	*See* SLAC-PUB-4143	E 1.99: DE87003264	MN -34D	12:10222
CONF-860944-	(29. conference on analytical chemistry in energy technology, Knoxville, TN, USA, 29 Sep-2 Oct 1986)			
2	*See* DP-MS-86-93	E 1.99: DE87002659	MN -32	12:10622
CONF-860980-	(6. Tihany symposium on radiation chemistry, Lake Balaton, Hungary, 21-26 Sep 1986)			
1	*See* BNL-38802	E 1.99: DE87002154	MN -4	12:9540
CONF-860990-	(8. annual participants' information meeting of the DOE Low-Level Waste Management Program, Denver, CO, USA, 22-26 Sep 1986)			
12	*See* PNL-SA-14291	E 1.99: DE87003094	MN -70B	12:8980
13	*See* BNL-38903	E 1.99: DE87003210	MN -70B	12:8924
CONF-8609105-	(Annual meeting of the Human Factors Society, Dayton, OH, USA, 30 Sep-3 Oct 1986)			
7	*See* PNL-SA-14094	E 1.99: DE87003173	MN -41	12:10009
CONF-8609122-	(15. North American Thermal Analysis Society conference, Cincinnati, OH, USA, 21-24 Sep 1986)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003142	MN -95c	12:9319
CONF-8609131-	(8. international free electron laser conference, Glasgow, UK, 1-5 Sep 1986)			
8	*See* LA-UR-86-3985	E 1.99: DE87002898	MN -28	12:9762
CONF-8609138-	(5. europhysical topical conference on lattice defects in ionic materials, Madrid, Spain, 8-12 Sep 1986)			
4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002406	MN -25	12:9427
CONF-8609142-	(Lattice gauge theory meeting, Upton, NY, USA, 15-19 Sep 1986)			
1	*See* SLAC-PUB-4147	E 1.99: DE87003668	MN -34D	12:10262

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CONF-8609147-	(American Nuclear Society annual meeting, Bethesda, MD, USA, 15-17 Sep 1986)			
4	*See* EGG-10282-1129	E 1.99: DE87002858	MN -41	12:9001
5	*See* EGG-10282-1126	E 1.99: DE87002860	MN -41	12:9911
7	*See* EGG-10282-1130	E 1.99: DE87002857	MN -41	12:10047
9	*See* EGG-10282-1125	DE87002861	MN -41	12:10082
10	*See* EGG-10282-1117	E 1.99: DE87002855	MN -41	12:9910
11	*See* EGG-10282-1127	E 1.99: DE87002859	MN -41	12:10112
CONF-8609151-	(7. international symposium on high energy spin physics, Protvino, USSR, 22-27 Sep 1986)			
2	*See* LA-UR-86-3749	E 1.99: DE87002926	MN -34D	12:10219
3	*See* LA-UR-86-3859	E 1.99: DE87002905	MN -34C	12:10303
CONF-8609163-	(International conference and symposia on unified concepts of many-body problems, Stony Brook, NY, USA, 4-6 Sep 1986)			
4	NTIS, PC A02; 3	DE87002418	MN -34C	12:10225
CONF-8609170-	(International conference on machine inspection of printed security documents, Long Beach, CA, USA, 25-26 Sep 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87000355	MN -13	12:10618
CONF-8609173-	(2. conference on hypercube multiprocessors, Knoxville, TN, USA, 29-30 Sep 1986)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002625	MN -32	12:10636
4	*See* LA-UR-86-3887	E 1.99: DE87002902	MN -32	12:10656
CONF-8609190-	(18. summer school on nuclear structure studies by means of nuclear reactions, Mikolajki, Poland, 1-13 Sep 1986)			
1	*See* BNL-38618	E 1.99: DE87001378	MN -34C	12:10354
CONF-8609191-	(Seminar on the cycling of long-lived radionuclides in biosphere: observation and models, Madrid, Spain, 15-19 Sep 1986)			
1-Trans.	*See* ORNL/tr-86/55	E 1.99: DE87002424	MN -11	12:9953
3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001678	MN -11	12:9939
CONF-8609197-	(9. international gas bearing symposium, Washington, DC, USA, 8-10 Sep 1986)			
1	*See* UCRL-95314	E 1.99: DE87002381	MN -38	12:9642
CONF-8609200-	(5. thematic conference on remote sensing for exploration geology, Reno, NV, USA, 29 Sep-1 Oct 1986)			
1	*See* PNL-SA-13832	E 1.99: DE87003095	MN -11	12:10099
CONF-8609201-	(Conference on the world view of contemporary physics: is there a need for a new metaphysics?, Fort Collins, CO, USA, 25-28 Sep 1986)			
1	*See* LBL-22248	E 1.99: DE87002575	MN -34D	12:10291
CONF-8609202-	(Focus '86 (technology transfer), Albuquerque, NM, USA, 9 Sep 1986)			
1	*See* EGG-M-32886	E 1.99: DE87002596	MN -13	12:9243
CONF-8609203-	(International symposium on in vivo body composition studies, Upton, NY, USA, 28 Sep-1 Oct 1986)			
1	*See* BNL-38929	E 1.99: DE87003198	MN -48	12:10029
2	*See* BNL-38902	E 1.99: DE87003200	MN -48	12:10028
CONF-8609204-	(3. international workshop on wind and water tunnel modeling of atmospheric flow and dispersion, Lausanne, Switzerland, 15-19 Sep 1986)			
1	*See* LA-UR-86-3596	E 1.99: DE87001972	MN -11	12:9887
CONF-8609205-	(Conference on temporal disorder in human oscillatory systems, Bremen, F.R. Germany, 8-12 Sep 1986)			
1	*See* LA-UR-86-3744	E 1.99: DE87002928	MN -48	12:10038
CONF-8609209-	(Workshop on the relations between structure and reactions in nuclear physics, Philadelphia, PA, USA, 15-18 Sep 1986)			
1	*See* LA-UR-86-3998	E 1.99: DE87002894	MN -34C	12:10390
CONF-861002-	(Automotive technology development contractors' coordination meeting, Dearborn, MI, USA, 27-30 Oct 1986)			
1	*See* DOE/NASA/50112-67	E 1.99: DE87003288	STD -96	12:9340
CONF-861007-	(Nuclear science and nuclear power systems symposium, Washington, DC, USA, 29-31 Oct 1986)			
6	*See* EGG-M-14086	E 1.99: DE87002611	MN -78	12:9167
7	*See* EGG-M-13886	E 1.99: DE87002610	MN -78	12:9121
9	*See* SLAC-PUB-4116	DE87003263	MN -28	12:9846
10	*See* SLAC-PUB-4095	E 1.99: DE87003271	MN -28	12:9842
11	*See* SLAC-PUB-4108	E 1.99: DE87003260	MN -37	12:9845
12	*See* SLAC-PUB-4105	DE87003277	MN -28	12:9843
13	*See* SLAC-PUB-4107	E 1.99: DE87003261	MN -28	12:9844
15	*See* UCRL-95562	DE87002558	MN -41	12:9924
18	*See* PNL-SA-14411	E 1.99: DE87003301	MN -41	12:9839
CONF-861019-	(10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society, Baltimore, MD, USA, 27-31 Oct 1986)			
13	*See* SAND-86-2426C	E 1.99: DE87002477	MN -4	12:9559
16	*See* LBL-22105	E 1.99: DE87001890	MN -94cc	12:9602
18	*See* KMSF-U-1754	E 1.99: DE87002822	MN -21	12:10565
19	*See* SAND-86-0531C	E 1.99: DE87003038	MN -25	12:9490

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CONF-861028-	(American Physical Society Nuclear Physics Division meeting, Vancouver, Canada, 9-11 Oct 1986)			
2-Vugraphs	*See* BNL-38867	DE87003214	MN -34	12:10282
CONF-861035-	(2. international meeting on simulation methods in nuclear engineering, Montreal, Canada, 14-16 Oct 1986)			
30	*See* LA-UR-86-3694	E 1.99: DE87001987	MN -78	12:9194
CONF-861038-	(OSA/APS international laser science conference, Seattle, WA, USA, 20-24 Oct 1986)			
1	*See* LA-UR-86-4052	E 1.99: DE87002890	MN -34	12:10162
2	*See* SAND-86-1307C	E 1.99: DE87003030	MN -38	12:9647
CONF-861044-	(Hanford Life Sciences symposium: radiation protection-a look to the future - celebrating four decades of research at Hanford, Richland, WA, USA, 21-23 Oct 1986)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002416	MN -41	12:9893
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002815	MN -48	12:10045
CONF-861076-	(Fall meeting of the Metallurgical Society of AIME, Orlando, FL, USA, 5-9 Oct 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001680	MN -25	12:9359
CONF-861080-	(Society of Petroleum Engineers annual technical conference and exhibition, New Orleans, LA, USA, 5-8 Oct 1986)			
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8868
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8869
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8873
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8874
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8875
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8876
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8877
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8878
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8879
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8880
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8881
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8882
	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836			12:8893
6	*See* EGG-M-24786	TI87000484	ND -66	12:8871
CONF-8610110-	(15. international colloquium on group theoretical methods in physics, Philadelphia, PA, USA, 20-24 Oct 1986)			
1	*See* LA-UR-86-4012	E 1.99: DE87002895	MN -34C	12:10391
CONF-8610115-	(4. international symposium on the production and neutralization of negative ions and beams, Upton, NY, USA, 27-31 Oct 1986)			
3	*See* UCRL-95575	E 1.99: DE87002557	MN -20f	12:10588
8	*See* TRI-PP-86-106	DE87900305	MN -28	12:9770
CONF-8610135-	(14. water reactor safety information meeting, Gaithersburg, MD, USA, 27-31 Oct 1986)			
9	NTIS, PC A03; 3	DE87002179	MN -78	12:9162
10	*See* SAND-86-1989C	E 1.99: DE87002702	MN -78	12:9209
11	*See* EGG-M-34086	E 1.99: DE87002607	MN -78	12:9177
14	*See* EGG-M-21486	E 1.99: DE87002601	MN -78	12:9168
15	*See* EGG-M-20986	E 1.99: DE87002602	MN -78	12:9128
16	*See* SAND-86-2220C	E 1.99: DE87001732	MN -78	12:9210
17	*See* EGG-M-21586	E 1.99: DE87002599	MN -78	12:9169
18	*See* EGG-M-22486	E 1.99: DE87002618	MN -78	12:9172
19	*See* EGG-M-22086	E 1.99: DE87002616	MN -78	12:9170
20	*See* SAND-86-2547C	E 1.99: DE87002056	MN -78	12:9214
21	*See* SAND-86-2521C	E 1.99: DE87002054	MN -78	12:9213
22	*See* LA-UR-86-3690	TI87001983	MN -78	12:9190
23	*See* EGG-M-22286	E 1.99: DE87002613	MN -78	12:9171
24	*See* EGG-M-23286	E 1.99: DE87002598	MN -78	12:9175
25	*See* EGG-M-22786	E 1.99: DE87002619	MN -78	12:9174
26	*See* EGG-M-22586	E 1.99: DE87002617	MN -78	12:9173
28	*See* EGG-M-25686	E 1.99: DE87002606	MN -78	12:9176
29	*See* SAND-86-2464C	E 1.99: DE87001736	MN -78	12:9211
31	*See* LA-UR-86-3691	E 1.99: DE87001984	MN -78	12:9191
32	*See* LA-UR-86-3695	E 1.99: DE87001988	MN -78	12:9195
33	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001833	MN -78	12:9163
34	*See* SAND-86-1950C	E 1.99: DE87001740	MN -78	12:9208
35	*See* LA-UR-86-3692	E 1.99: DE87001985	MN -78	12:9192

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36	*See* LA-UR-86-3693	E 1.99: DE87001986	MN -78	12:9193
37	*See* SAND-86-2520C	E 1.99: DE87001729	MN -78	12:9212
38	*See* BNL-NUREG-38916	TI87003212	MN -78	12:9160
41	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002180	MN -78	12:9164
CONF-8610163-	(5. annual workshop on turbine engine hot section technology, Cleveland, OH, USA, 21-22 Oct 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001692	MN -25	12:9362
CONF-8610165-	(Space photovoltaic research and technology conference, Cleveland, OH, USA, 7-9 Oct 1986)			
1	*See* SAND-86-2396C	E 1.99: DE87000981	MN -63	12:9049
CONF-8610166-	(MELCOR user's meeting, Rockville, MD, USA, 30 Oct 1986)			
1	*See* SAND-86-1834C	E 1.99: DE87000982	MN -79p	12:9207
CONF-8610169-	(Department of Energy industrial heat pump workshop, Atlanta, GA, USA, 14-15 Oct 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001679	MN -95f	12:9311
CONF-8610170-	(Department of Energy's workshop on workplace aerosol monitoring, Napa, CA, USA, 29 Oct 1986)			
1	*See* PNL-SA-13389	E 1.99: DE87001802	MN -48	12:9008
CONF-8610171-	(Workshop on concepts in inhalation toxicology, Albuquerque, NM, USA, 20-23 Oct 1986)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001827	MN -48	12:10077
CONF-8610172-	(International new materials conference and exhibition, Osaka, Japan, 16-19 Oct 1986)			
1	*See* LBL-22331	E 1.99: DE87002546	MN -25	12:9402
CONF-8610173-	(11. conference on cyclotrons and their applications, Tokyo, Japan, 13-17 Oct 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001820	MN -34A	12:9776
7	*See* TRI-PP-86-95	DE87900311	MN -28	12:9769
CONF-8610175-	(4. symposium on liquid chromatography-mass spectrometry, Montreux, Switzerland, 22-24 Oct 1986)			
1	*See* PNL-SA-13885	E 1.99: DE87002712	MN -4	12:9508
CONF-8610176-	(5. international school on neutron physics, Alushta, USSR, 20-31 Oct 1986)			
1	*See* DOE/ER/40048-183	E 1.99: DE87003139	MN -34C	12:10263
2	*See* BNL-38900	E 1.99: DE87003195	MN -34C	12:10355
CONF-8610177-	(Solid science meeting, Livermore, CA, USA, 6-9 Oct 1986)			
2	*See* MLM-3398(OP)	E 1.99: DE87003026	MN -34	12:10438
7	*See* MLM-3399(OP)	E 1.99: DE87003025	MN -25	12:9031
CONF-8610178-	(TRADE conference, Las Vegas, NV, USA, 27-29 Oct 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002169	MN -41	12:10046
2	*See* PNL-SA-14371	E 1.99: DE87002473	MN -15	12:9020
CONF-8610180-	(Fall meeting of the Western States Section/Combustion Institute, Tucson, AZ, USA, 27-28 Oct 1986)			
2	*See* LBL-20871	E 1.99: DE87001887	MN -4	12:9627
CONF-8610181-	(Seminar on new aspects of plant cell biology and molecular biology, Kashiko-Jima, Japan, 20-24 Oct 1986)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001681	MN -48	12:9044
CONF-8610190-	(Workshop on electromagnetic field computations, Schnectady, NY, USA, 20-21 Oct 1986)			
1	*See* BNL-38943	E 1.99: DE87003229	MN -28	12:9727
CONF-861102-	(American Nuclear Society and Atomic Industrial Forum joint meeting, Washington, DC, USA, 16-21 Nov 1986)			
28	*See* MLM-3407(OP)	E 1.99: DE87003021	MN -70A	12:8967
29	*See* PNL-SA-14342	E 1.99: DE87003304	MN -70	12:8981
30	*See* PNL-SA-14463	E 1.99: DE87003302	MN -70	12:8982
CONF-861104-	(International symposium on nuclear material safeguards, Vienna, Austria, 10-14 Nov 1986)			
10	*See* K/OA-6009	E 1.99: DE87002524	MN -15	12:9016
11	*See* MLM-3408(OP)	E 1.99: DE87003022	MN -15	12:9018
12	*See* MLM-3409-OP	E 1.99: DE87003023	MN -15	12:9019
13	*See* PNL-SA-14402	E 1.99: DE87003097	MN -15	12:9021
CONF-861106-	(IAEA international conference on plasma physics and controlled nuclear fusion research, Kyoto, Japan, 12-19 Nov 1986)			
11-Rev.1	*See* UCRL-95567-Rev.1	E 1.99: DE87002380	MN -20a	12:10587
13	*See* IAEA-CN-47/E-II-3-2	E 1.99: DE87002405	MN -20	12:10479
14	*See* UCRL-95435	E 1.99: DE87003395	MN -20a	12:10585
CONF-861110-	(American Physical Society Plasma Physics Division meeting, Baltimore, MD, USA, 3-7 Nov 1986)			
2	*See* SAND-86-1582C	E1.99: DE87002486	MN -28	12:9766
CONF-861111-	(Conference on magnetism and magnetic materials, Baltimore, MD, USA, 17-21 Nov 1986)			
15	*See* BNL-38688	E 1.99: DE87001459	MN -25	12:9354
16	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003010	MN -25	12:9451
CONF-861114-	(9. international conference on application of accelerators in research and industry, Denton, TX, USA, 10-12 Nov 1986)			
23	*See* LA-UR-86-3398	E 1.99: DE87001955	MN -28	12:10218
29	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002628	MN -34A	12:10432

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30	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003007	MN -34A	12:10150
31	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003011	MN -28	12:9747
32	*See* UCRL-95317	E 1.99: DE87003251	MN -28	12:9726
33	*See* PNL-SA-14125	E 1.99: DE87003308	MN -41	12:10062
CONF-861123-	(CEC/CEA international workshop on age-related factors in radionuclide metabolism and dosimetry, Angers, France, 26-28 Nov 1986)			
1	NTIS, PC A02; 3	DE87003009	MN -41	12:10423
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003003	MN -41	12:10424
CONF-861143-	(IAEA technical committee meeting on fusion reactor safety, Culham, UK, 3-7 Nov 1986)			
1	*See* EGG-M-30686	E 1.99: DE87002605	MN -20e	12:10553
CONF-861146-	(AIChE winter annual meeting, Miami, FL, USA, 2-7 Nov 1986)			
9	*See* MLM-3406(OP)	E 1.99: DE87003020	MN -22	12:9556
10	*See* PNL-SA-13738	E 1.99: DE87003172	MN -10	12:8976
CONF-861165-	(5. joint conference on applications of air pollution meteorology, Chapel Hill, NC, USA, 18-21 Nov 1986)			
5	*See* PNL-SA-13894	E 1.99: DE87003170	MN -11	12:9890
CONF-861185-	(Reduced Enrichment for Research and Test Reactors (RERTR) program international meeting, Gatlinburg, TN, USA, 3-6 Nov 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002178	MN -80	12:9140
CONF-861186-	(Westinghouse engineering computer applications symposium, Monroeville, PA, USA, 3-5 Nov 1986)			
1	*See* WAPD-T-2885	E 1.99: DE87000901	MN -32	12:10663
CONF-861189-	(Numerical algorithms for modern parallel computer workshop, Minneapolis, MN, USA, 3-7 Nov 1986)			
1	*See* BNL-38792	E 1.99: DE87002590	MN -32	12:10631
CONF-861190-	(Conference on signals, systems and computers, Pacific Grove, CA, USA, 11 Nov 1986)			
1	*See* SAND-86-1341C	DE87002700	MN -38	12:9630
CONF-861191-	(Compact toroid workshop, Osaka, Japan, 21-22 Nov 1986)			
1	*See* LA-UR-86-3875	E 1.99: DE87002903	MN -20d	12:10568
2	*See* LA-UR-86-3813	E 1.99: DE87002913	MN -20f	12:10567
CONF-861193-	(IAEA specialists' meeting on covariance methods and practices in the field of nuclear data, Rome, Italy, 17-19 Nov 1986)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002420	MN -34C	12:10284
CONF-8611100-	(PNWIS/APCA annual meeting, Eugene, OR, USA, 19-21 Nov 1986)			
1	*See* PNL-SA-14331	E 1.99: DE87003300	MN -41	12:9905
CONF-861207-	(Materials Research Society fall meeting, Boston, MA, USA, 1-5 Dec 1986)			
6	*See* LA-UR-86-4066	E 1.99: DE87002889	MN -25	12:9400
7	*See* LA-UR-86-4041	E 1.99: DE87002893	MN -25	12:9399
8	*See* LA-UR-86-4047	E 1.99: DE87002892	MN -25	12:9441
9	*See* LA-UR-86-3997	E 1.99: DE87002896	MN -25	12:9398
10	*See* SAND-86-1359C	E 1.99: DE87003031	MN -25	12:9408
11	*See* SAND-86-1402C	E 1.99: DE87003034	MN -25	12:9492
12	*See* SAND-86-1395C	E 1.99: DE87003033	MN -25	12:9491
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003000	MN -25	12:9360
15	*See* LA-UR-86-3811	E 1.99: DE87002914	MN -25	12:9397
16	*See* SAND-86-2192C	E 1.99: DE87002484	MN -70	12:8986
17	*See* SAND-86-1418C	E 1.99: DE87003154	MN -25	12:9350
18	*See* PNL-SA-14218	E 1.99: DE87002871	MN -25	12:9407
19	*See* PNL-SA-14056	E 1.99: DE87003093	MN -85	12:8978
20	*See* PNL-SA-14069	E 1.99: DE87002872	MN -25	12:9406
CONF-861211-	(American Society of Mechanical Engineers winter meeting, Anaheim, CA, USA, 7-12 Dec 1986)			
14	*See* LBL-22036	E 1.99: DE87001716	MN -4	12:9601
CONF-861227-	(Superfund '86, Washington, DC, USA, 1-3 Dec 1986)			
2	*See* PNL-SA-14065	E 1.99: DE87003099	MN -70	12:8979
CONF-861239-	(Topical meeting on dissipative instabilities in toroidal devices (US/USSR exchange), Moscow, USSR, 8-16 Dec 1986)			
1	*See* GA-A-18637	E 1.99: DE87002387	MN -20	12:10474
CONF-870101-	(American Society of Heating, Refrigerating, and Air-Conditioning Engineers meeting, New York, NY, USA, 18-21 Jan 1987)			
3	NTIS, PC A03; 3	DE87002810	MN -95d	12:9290
CONF-870103-	(2. international conference on constitutive laws for engineering materials, Tucson, AZ, USA, 5-10 Jan 1987)			
4	*See* SAND-86-0178C	E 1.99: DE86014141	MN -11	12:10109
CONF-870108-	(20. annual Hawaii international conference on system sciences, Honolulu, HI, USA, 6-9 Jan 1987)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86014102	MN -21	12:10471

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CONF-870129-	(Society of Computer Simulation emergency planning multiconference, San Diego, CA, USA, 14-16 Jan 1987)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001698	MN -11	12:9894
CORR-				
84-00250	NTIS, PC A07; 3	DE87003110	MN -11	12:9899
86-00385	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE87003102	MN -41	12:9982
CRN-CPR-				
85-16	NTIS (US Sales Only), PC A03/MF A01	DE87750753	MN -34C	12:10412
CRN-PN-				
85-32	NTIS (US Sales Only), PC A07/MF A01	DE87750728	MN -34C	12:10327
85-34	NTIS (US Sales Only), PC A06/MF A01	DE87750727	MN -34C	12:10328
CSTB-EN-CLI-				
84-9	NTIS (US Sales Only), PC A02/MF A01; 1	DE87750436	MN -95	12:9882
CTA-IEAV-RP-				
025/ 85	NTIS (US Sales Only), PC A03/MF A01	DE87700466	MN -79	12:9113
DEMO-				
84/ 2	NTIS (US Sales Only), PC A03; 3	DE87900235	MN -78	12:9165
84/ 5	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900233	MN -41	12:9989
84/ 9-E	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900232	MN -11	12:10083
84/ 11	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900228	MN -78	12:9166
DESY-T-				
85-01	NTIS (US Sales Only), PC A06/MF A01	DE87750320	MN -34D	12:10226
DF-				
61980	*See* DOE/DP/00789-T253	E 1.99: DE87003248	MN -2	12:9346
61980	*See* DOE/NBM-7003247	E 1.99: DE87003247	MN -2	12:9347
DFVLR-FB-				
84-42	NTIS (US Sales Only), PC A04/MF A01; 1	DE87750807	MN -11	12:9883
DOE/AL/33218-				
T6	NTIS, PC A02; 3	DE87002719	MN -71	12:8908
DOE/BP/11191-				
4	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87002663	MN -60	12:9075
DOE/BP/39830-				
2	NTIS, PC A06; 3	DE87003085	MN -11	12:9041
DOE/CE-				
0165	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002958	MN -95	12:9256
0166-Vol.1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE87003293	MN -95d	12:9291
0166-Vol.2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87003294	MN -95d	12:9292
0171	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002988	MN -95	12:9257
0173	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87003613	MN -95f	12:9428
DOE/CE/23858-				
1	NTIS, PC A17/MF A01; 1 (GPO Dep.)	E 1.99: DE87002441	MN -95d	12:9293
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T3	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE87002777	MN -95d	12:9295
DOE/CE/26525-				
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87002718	MN -95d	12:9320
DOE/CE/40651-				
1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87002941	MN -96	12:9280
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0035	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003679	MN -15	12:9012
DOE/DP/00789-				
T253	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE87003248	MN -2	12:9346
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1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE87003119	MN -21	12:10549
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1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003120	MN -20a	12:10550
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0305	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002665	MN -11	12:10006
DOE/EIA-				
0035-86/ 08	NTIS, PC A07/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87002882	MN -98	12:9274
0109-86/ 09	NTIS, PC A06/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87002881	MN -98B	12:8888
0130(86/ 09)	NTIS, PC A08/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87003336	MN -98C	12:8895
0167(85)	NTIS, PC A07/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87003338	MN -98C	12:8897
0376(84)	NTIS, PC A11/MF A01 - GPO (GPO Dep.)	E 1.99: DE87003378	MN -98	12:9275
0380(86/ 09)	NTIS, PC A08/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87003337	MN -98B	12:9265
0478(85)	NTIS, PC A07/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87003059	MN -98F	12:9248
0499	NTIS, PC A06/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87002887	MN -98E	12:9267
DOE/ER-				
0254	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE87003219	MN -11	12:9956
0299	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE87003287	STD -11	12:9900
0305	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830	TI87003384	STD -05	12:9242
0306	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003286	STD -32	12:10637
DOE/ER/03077-				
275	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003258	MN -92a	12:8870
DOE/ER/03416-				
T3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003144	MN -4	12:9603
DOE/ER/03948-				
18	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003326	MN -34C	12:10307
DOE/ER/04650-				
T3	NTIS, PC A03; 3	DE87003374	MN -34	12:9626
DOE/ER/04936-				
T2	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE86014193	MN -34C	12:10152
DOE/ER/10336-				
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002952	MN -34D	12:10227

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DOE/ER/10423-T3	NTIS, PC A04/MF A01; 1		DE87002825	MN -34C	12:10300
DOE/ER/10494-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003312	MN -34C	12:10331
DOE/ER/10612-17	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002453	MN -4	12:9541
DOE/ER/10635-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002720	MN -34A	12:10153
DOE/ER/12045-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002076	MN -4	12:9542
DOE/ER/12076-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003372	MN -25	12:9429
DOE/ER/12088-12	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003178	MN -4	12:9543
DOE/ER/13115-T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87001639	MN -4	12:9544
DOE/ER/13147-2-Pt.7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87000763	MN -34	12:10443
DOE/ER/13285-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002497	MN -32	12:10638
DOE/ER/13339-2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003320	MN -48	12:10012
DOE/ER/13525-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002809	MN -48	12:10013
DOE/ER/25007-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003136	MN -32	12:10639
DOE/ER/40048-183	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003139	MN -34C	12:10263
DOE/ER/40096-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003161	MN -34C	12:9794
DOE/ER/40118-4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003386	MN -34D	12:10121
DOE/ER/40211-2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002944	MN -34D	12:10228
DOE/ER/40273-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003315	MN -34D	12:10266
DOE/ER/45198-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002528	MN -25	12:9363
DOE/ER/45222-3	NTIS, PC A02; 3		DE87000986	MN -34A	12:10433
DOE/ER/52125-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003138	MN -38	12:9645
DOE/ER/53005-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003146	MN -20a	12:10472
DOE/ER/53221-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002440	MN -20	12:10473
DOE/ER/60006-5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003334	MN -90i	12:8851
DOE/ER/60023-2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002226	MN -11	12:9901
DOE/ER/60069-T4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86015601	MN -48	12:10014
DOE/ER/60197-3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002540	MN -11	12:10084
DOE/ER/60269-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003137	MN -11	12:9884
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DOE/ER/60304-2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003373	MN -11	12:9885
DOE/ER/60311-2	NTIS, PC A06; 3		DE87002483	MN -11	12:9958
DOE/ER/60401-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001928	MN -48	12:10031
DOE/ER/70005-4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003135	MN -34B	12:10147
DOE/ER/72027-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002998	MN -4	12:9545
DOE/ET/29046-T1	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008525	MN -97a	12:9082
T2	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008524	MN -97a	12:9083
DOE/ET/34013-12	NTIS (US Sales Only), PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003624	STD -78	12:9095
DOE/ET/34212-50	NTIS (US Sales Only), PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002850	STD -78	12:9096
DOE/ET/51013-195	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002770	MN -20	12:10551
196	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002771	MN -20b	12:10552
DOE/EV/10430-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003182	MN -48	12:10078
DOE/EV/70134-T10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003104	MN -11	12:9983

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0076	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003281	MN -92	12:8892
DOE/FE/60339-					
T30	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002783	MN -90a	12:8836
T31	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002786	MN -90e	12:8862
T32	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002790	MN -90d	12:8807
T33	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002792	MN -90a	12:8837
T34	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87002787	MN -90b	12:8863
T35	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002791	MN -90a	12:8816
T36	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002789	MN -90a	12:8808
T37	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002795	MN -90a	12:9546
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12104	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87002842	STD -41	12:10425
DOE/ID/12493-					
T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003117	MN -61E	12:9032
DOE/ID/12578-					
T1	NTIS, PC A04; 3		DE87002597	MN -66	12:9074
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0008	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003616	MN -98E	12:9268
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0233	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830		TI87003448	STD -13	12:10620
DOE/JPL/954334-					
T22	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002680	MN -63b	12:9045
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2205	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87001011	STD -11	12:9902
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0214	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003298	MN -13	12:10621
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T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004630	MN -90c	12:8818
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0247-3	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002841	STD -60	12:9076
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67	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003288	STD -96	12:9340
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0080	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003292	STD -11	12:9886
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7003141	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003141	MN -34	12:10434
7003247	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003247	MN -2	12:9347
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T277	Springer-Verlag New York, Inc., Service Center, 44 Hartz Way, Secaucus, NJ 07094		TI87002362	BK -11	12:9908
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32	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002238	MN -90d	12:8819
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T13	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003131	MN -90b	12:8858
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13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002685	MN -90d	12:8820
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DOE/PC/80508-				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003220	MN -90a	12:8841
DOE/PC/80511-				
T5	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003164	MN -90c	12:9690
DOE/PC/80514-				
05	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87002867	MN -90a	12:8842
DOE/PC/80516-				
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003430	MN -90a	12:8824
DOE/PC/80521-				
T5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002679	MN -90a	12:9549
DOE/PC/80528-				
T5	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE87002873	MN -90e	12:8865
DOE/PC/80531-				
T5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002708	MN -90d	12:8825
DOE/PC/80753-				
T4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002356	MN -90b	12:8814
DOE/PC/80910-				
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DOE/PC/80913-				
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003391	MN -90a	12:8827
DOE/PC/81008-				
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DOE/RW-				
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0120	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003680	MN -85	12:8909
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0052	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002956	MN -78	12:9249
DOE/SF/00515-				
T70	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003017	MN -28	12:9705
DOE/SF/11721-				
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DPH-N-S-				
2321	*See* CEA-CONF-8304	DE87750038	MN -34C	12:10356
2322	*See* CEA-CONF-8322	DE87750707	MN -34C	12:10357
DPSP-				
84-1-1-Del.Ver.	NTIS, PC A06; 3	DE87003116	MN -2	12:9085
DPST-				
83-652	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003112	MN -70	12:8931
84-627	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002638	MN -4	12:9613
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86-348	NTIS, PC A02; 3	DE87002643	MN -11	12:9136
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2639-1	*See* N-86-31652			12:9671
2945	*See* N-86-31649			12:9637
3057	*See* N-86-31982			12:9220
3203	*See* N-86-32573			12:9487
ECS-SR-				
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802(29) -85	NTIS (US Sales Only), PC A03/MF A01	DE87700199	MN -34D	12:10229
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820(47) -85	NTIS (US Sales Only), PC A03/MF A01	DE87700204	MN -34D	12:10177
EGG-				
2463-Vol.1	*See* NUREG/CR-4684-Vol.1	TI87003028	MN -78	12:9154
2463-Vol.2	*See* NUREG/CR-4684-Vol.2	TI87003042	MN -78	12:9155
10282-1117	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002855	MN -41	12:9910
10282-1125	NTIS, PC A02; 3	DE87002861	MN -41	12:10082

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10282-1127	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002859	MN -41	12:10112
10282-1129	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002858	MN -41	12:9001
10282-1130	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002857	MN -41	12:10047
10282-2123	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003165	MN -92a	12:8890
10282-2124	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003158	MN -11	12:9927
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13886	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002610	MN -78	12:9121
14086	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002611	MN -78	12:9167
17986	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87001441	MN -41	12:10426
20986	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002602	MN -78	12:9128
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22086	NTIS, PC A02/MF A01 - GPO; 1 (GPO Dep.)	E 1.99: DE87002616	MN -78	12:9170
22286	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002613	MN -78	12:9171
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24786	Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083-3836	TI87000484	ND -66	12:8871
25686	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002606	MN -78	12:9176
30686	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002605	MN -20e	12:10553
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599	NTIS (US Sales Only), PC A03/MF A01	DE87700218	MN -11	12:9990
EMA-				
86-R-07	*See* AD-A-172432/7/XAB			12:9860
ENEA-RT-TERM-				
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ENEA-RT-TIB-				
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ENEA-RT-VEL-				
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ENR-I-				
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ENV-MER-				
81-133	NTIS (US Sales Only), PC A08; 3	DE87750438	MN -95e	12:9312
EPA-				
600/ J-86/ 131	*See* PB-87-100590/XAB			12:10080
EPRI-AP-				
4681	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920100	ND -90e	12:9077
4873	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920099	ND -90b	12:8831
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4419-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920074	ND -90i	12:9313
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4833	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920106	ND -90d	12:9080
4839	NTIS, PC A03/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1 (GPO Dep.)	E 1.99: DE87003328	MN -41	12:9940
4844	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920142	ND -90e	12:9692
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4838	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920116	ND -11	12:10000
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EPRI-EM-				
4519-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920128	ND -98E	12:9271
4693	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920124	ND -95f	12:9314
4815-SR	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920126	ND -98E	12:9272
4885	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920127	ND -98E	12:10619
EPRI-NP-				
4775	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920134	ND -80	12:9129
4874-Vol.1	NTIS, PC A22/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1 (GPO Dep.)	E 1.99: DE87003332	MN -78	12:9179
4887	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99: DE87003329	STD -85	12:8910
4897	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920135	ND -80	12:9130
4898	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920140	ND -78	12:9097
4899	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920141	ND -78	12:9180
4926	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920131	ND -78	12:9087
4942	Research Reports Center, Box 50490, Palo Alto, CA 94303; 1	TI87920129	ND -78	12:9181
EUR-				
9049	Commission of the European Communities, Luxembourg		ND -93A	12:9282
9140	Commission of the European Communities, Luxembourg		ND -95	12:9315
9141	Commission of the European Communities, Luxembourg		ND -88	12:8861
9256	Commission of the European Communities, Luxembourg		ND -95d	12:9297
9261	Commission of the European Communities, Luxembourg		ND -94cb	12:9221
9309	Commission of the European Communities, Luxembourg		ND -59A	12:9068
9405	Commission of the European Communities, Luxembourg		ND -94cb	12:9222
9407	Commission of the European Communities, Luxembourg		ND -90c	12:8832
9616e	*See* KFK-4077	DE87750326	MN -15	12:9017
9730	Commission of the European Communities, Luxembourg		ND -25	12:9364
9788	Commission of the European Communities, Luxembourg		ND -95d	12:9298
9818	Commission of the European Communities, Luxembourg		ND -90e	12:8866
9911	Commission of the European Communities, Luxembourg		ND -59A	12:9062
FERC/DEIS-				
0040-S	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87002833	MN -11	12:9042
FhG-IzfP-				
780157-TW	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken, Germany, F.R., Inst. fuer Zerstoerungsfreie Pruefverfanren		ND -25	12:9679
790218-TW	Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken, Germany, F.R., Inst. fuer Zerstoerungsfreie Pruefverfanren		ND -25	12:9680
FMPC-				
2040	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE87003062	MN -70	12:8932
2048	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE87003125	MN -11	12:9002
FNAL/C-				
86/ 115	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002077	MN -34D	12:10178
86/ 124	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002213	MN -28	12:9748
FRNC-TH-				
2139	Toulouse-3 Univ., 31, France		ND -25	12:9365
2268	NTIS (US Sales Only), PC A09/MF A01	DE87750751	MN -38	12:9633
2284	NTIS (US Sales Only), PC A12/MF A01	DE87750756	MN -38	12:10440
2291	NTIS (US Sales Only), PC A13/MF A01	DE87750724	MN -78	12:9681
2300	NTIS (US Sales Only), PC A06/MF A01	DE87750725	MN -79a	12:9667
2355	NTIS (US Sales Only), PC A10/MF A01	DE87750749	MN -80	12:9134
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18637	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002387	MN -20	12:10474
GANIL-P-				
86-05	NTIS (US Sales Only), PC A03/MF A01	DE87750761	MN -34C	12:10358
GAT-T-				
3394	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002203	MN -38	12:9634
GEND-				
057	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003639	STD -78	12:9098

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85/ E/ 51	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900266	MN -4	12:9600
86/ E/ 22	NTIS (US Sales Only), PC A04/MF A01; 1	DE87750801	MN -92a	12:9698
86/ E/ 24	NTIS (US Sales Only), PC A03/MF A01; 1	DE87750800	MN -95d	12:9321
GRI-				
86/ 0132	NTIS, PC A08/MF A01	TI87900251	MN -92	12:8896
GRS-F-				
148	NTIS (US Sales Only), PC A12/MF A01	DE87750323	MN -80	12:9182
152	NTIS (US Sales Only), PC A04/MF A01	DE87750322	MN -80	12:9183
GSF-				
4/ 86	NTIS (US Sales Only), PC A06/MF A01; 1	DE87750797	MN -48	12:10079
8/ 86	Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R., Inst. fuer Pathologie		ND -48	12:10049
GSI-				
86-13	NTIS (US Sales Only), PC A05/MF A01	DE87750329	MN -21	12:10555
86-17	NTIS (US Sales Only), PC A03/MF A01	DE87750305	MN -34A	12:10154
86-23-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE87750304	MN -34C	12:10359
86-24-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE87750306	MN -34A	12:10155
86-27-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE87750318	MN -28	12:9706
86-29-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE87750319	MN -34C	12:10340
GSO-				
1985-0096	Geological Survey, Private Bag X112, Pretoria, 0001, South Africa		ND -51	12:9244
IAE-				
1966/ Cyfronet/ PM/ A	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -34D	12:10444
1975/ E-3/ R/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -80	12:9141
1976/ E-4/ PL/ A	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -34C	12:10318
1977/ E-3/ R/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -80	12:9142
1978/ E-1/ E/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -41	12:8992
3880/ 3	NTIS (US Sales Only), PC A02/MF A01	DE87700220	MN -48	12:9941
4114/ 6	NTIS (US Sales Only), PC A02/MF A01	DE87700192	MN -20	12:10475
4115/ 6	NTIS (US Sales Only), PC A03/MF A01	DE87700193	MN -20	12:10476
4116/ 6	NTIS (US Sales Only), PC A02/MF A01	DE87700194	MN -20	12:10477
4155/ 7	NTIS (US Sales Only), PC A02/MF A01	DE87700195	MN -20	12:10478
IAEA-CN-				
47/ E-II-3-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002405	MN -20	12:10479
47/ H-III-2	*See* UCRL-95435	E 1.99: DE87003395	MN -20a	12:10585
IAEA-HPRA-				
12	NTIS (US Sales Only), PC A11/MF A01	DE87700222	MN -41	12:10050
IAEA-NDS-				
0-Rev.86/ 7	NTIS (US Sales Only), PC A02/MF A01	DE87700305	MN -2	12:10285
7-Rev.86/ 7	NTIS (US Sales Only), PC A02/MF A01	DE87700306	MN -2	12:10286
79-Rev.0	NTIS (US Sales Only), PC A03/MF A01	DE87700307	MN -2	12:10292
80-Rev.0	NTIS (US Sales Only), PC A03/MF A01	DE87700308	MN -2	12:10293
IAEA-R-				
3355-F	NTIS (US Sales Only), PC A02/MF A01	DE87700267	MN -48	12:10051
3776-F	NTIS (US Sales Only), PC A02/MF A01	DE87700258	MN -4	12:9137
3844-F	NTIS (US Sales Only), PC A02/MF A01	DE87700271	MN -48	12:10081
IAEA-RL-				
134	NTIS (US Sales Only), PC A02/MF A01	DE87700256	MN -4	12:9503
IAEA-SM-				
293/ 81	*See* PNL-SA-14402	E 1.99: DE87003097	MN -15	12:9021
293/ 125	*See* MLM-3408(OP)	E 1.99: DE87003022	MN -15	12:9018
293/ 126	*See* MLM-3409-OP	E 1.99: DE87003023	MN -15	12:9019
293/ 128	*See* K/OA-6009	E 1.99: DE87002524	MN -15	12:9016
IAEA-TECDOC-				
375	NTIS (US Sales Only), PC A07/MF A01	DE87700224	MN -71	12:8911
ICASE-				
86-56	*See* N-86-33025			12:9628
ICP-CEH-				
129	NTIS (US Sales Only), PC A03/MF A01	DE87700223	MN -41	12:9184
IFVE-OTF-				
85-152	NTIS (US Sales Only), PC A02/MF A01	DE87700180	MN -34D	12:10267
85-184	NTIS (US Sales Only), PC A02/MF A01	DE87700179	MN -34D	12:10445
IITRI-C-				
06628	*See* DOE/PC/80753-T4	E 1.99: DE87002356	MN -90b	12:8814
IIUG/dp-				
85-3	NTIS (US Sales Only), PC A03/MF A01; 1	DE87750799	MN -11	12:10007
IIUG-pre-				
85-4	NTIS (US Sales Only), PC A03/MF A01	DE87750811	MN -11	12:9238

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
IN2P3-				
84-01	Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris, France		ND -34	12:10232
INDC(CPR)-				
8/ L	NTIS (US Sales Only), PC A02/MF A01	DE87700208	MN -34C	12:10360
009/ L	NTIS (US Sales Only), PC A02/MF A01	DE87700255	MN -34C	12:10346
INDC(GDR)-				
038/ L	NTIS (US Sales Only), PC A03/MF A01	DE87700212	MN -34C	12:10319
039/ L	NTIS (US Sales Only), PC A05/MF A01	DE87700213	MN -34C	12:10341
INDC(NDS)-				
179/ G	NTIS (US Sales Only), PC A09/MF A01	DE87700263	MN -25	12:9366
INFN/AE-				
86/ 7	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900279	MN -28	12:9707
INIS-BR-				
539	NTIS (US Sales Only), PC A07/MF A01	DE87700462	MN -78	12:9185
540	NTIS (US Sales Only), PC A05/MF A01	DE87700476	MN -2	12:10671
542	NTIS (US Sales Only), PC A06/MF A01	DE87700467	MN -80	12:9143
556	NTIS (US Sales Only), PC A04/MF A01	DE87700473	MN -37	12:9795
INIS-mf-				
4754-No.33	NTIS (US Sales Only), PC A04/MF A01	DE87700191	MN -20	12:10480
10311	NTIS (US Sales Only), PC A07/MF A01	DE87750324	MN -22	12:8904
10315	NTIS (US Sales Only), PC A12/MF A01	DE87750312	MN -11	12:9258
10504	NTIS (US Sales Only), PC A14/MF A01	DE86752934	MN -4	12:10056
10509	NTIS (US Sales Only), PC A13/MF A01	DE87700270	MN -48	12:9991
10511	NTIS (US Sales Only), PC A02/MF A01	DE87780030	MN -4	12:9505
10514	NTIS (US Sales Only), PC A05/MF A01	DE87700294	MN -70	12:8950
10515	NTIS (US Sales Only), PC A04/MF A01	DE87700477	MN -2	12:10674
10516	NTIS (US Sales Only), PC A03/MF A01	DE87700261	MN -25	12:9377
10517	NTIS (US Sales Only), PC A02/MF A01	DE87780056	MN -25	12:9381
10518	NTIS (US Sales Only), PC A04/MF A01	DE87700290	MN -37	12:9798
INIS-SU-				
353	NTIS (US Sales Only), PC A04/MF A01	DE87780034	MN -34D	12:10115
354	NTIS (US Sales Only), PC A04/MF A01	DE87780038	MN -20	12:10116
361	NTIS (US Sales Only), PC A04/MF A01	DE87780036	MN -34	12:10117
362	NTIS (US Sales Only), PC A04/MF A01	DE87780037	MN -34D	12:10118
373	NTIS (US Sales Only), PC A03/MF A01	DE87700187	MN -34A	12:9436
INIS-XN-				
20	NTIS (US Sales Only), PC A02/MF A01	DE87700295	MN -2	12:9254
21	NTIS (US Sales Only), PC A02/MF A01	DE87700296	MN -2	12:9255
22	NTIS (US Sales Only), PC A02/MF A01	DE87700297	MN -2	12:9122
25	NTIS (US Sales Only), PC A02/MF A01	DE87700304	MN -2	12:10690
30	NTIS (US Sales Only), PC A03/MF A01	DE87700298	MN -2	12:9013
31	NTIS (US Sales Only), PC A02/MF A01	DE87700299	MN -2	12:10428
32	NTIS (US Sales Only), PC A02/MF A01	DE87700300	MN -2	12:10429
33	NTIS (US Sales Only), PC A02/MF A01	DE87700301	MN -2	12:10035
34	NTIS (US Sales Only), PC A02/MF A01	DE87700302	MN -2	12:10036
35	NTIS (US Sales Only), PC A02/MF A01	DE87700303	MN -2	12:10037
52	NTIS (US Sales Only), PC A03/MF A01	DE87750722	MN -98	12:9260
53	NTIS (US Sales Only), PC A04/MF A01	DE87750723	MN -98	12:9235
INP-				
1206/ PL	NTIS (US Sales Only), PC A11/MF A01	DE87780035	MN -34D	12:10457
1222/ AP	NTIS (US Sales Only), PC A04/MF A01	DE87700217	MN -51	12:9928
INS-				
1967/ P-8/ PR/ A	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -34D	12:10458
1968/ P-8/ PR/ A	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -34D	12:10459
1982/ ZDAJ/ PL/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901, Warsaw, Poland		ND -28	12:9712
1983/ P-3/ E/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -37	12:9866
1987/ P-5/ PP/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -20	12:10493
1988/ P-3/ E/ B	Energetics and Atomic Energy Information Centre, Palace of Culture and Science, PL-00-901 Warsaw, Poland		ND -32	12:10642
IPNO-DRE-				
83-28	NTIS (US Sales Only), PC A02/MF A01	DE87750763	MN -34C	12:10337
83-31	NTIS (US Sales Only), PC A02/MF A01	DE87750710	MN -34C	12:10323
84-40	NTIS (US Sales Only), PC A02/MF A01	DE87750737	MN -34C	12:10349
85-01	NTIS (US Sales Only), PC A03/MF A01	DE87750735	MN -37	12:9867
85-13	NTIS (US Sales Only), PC A02/MF A01	DE87750734	MN -34C	12:10324
85-14	NTIS (US Sales Only), PC A04/MF A01	DE87750733	MN -34C	12:10301
85-20	NTIS (US Sales Only), PC A02/MF A01	DE87750785	MN -34C	12:10350
85-29	NTIS (US Sales Only), PC A03/MF A01	DE87750736	MN -4	12:9614
86-01	NTIS (US Sales Only), PC A02/MF A01	DE87750786	MN -34C	12:10320
86-03	NTIS (US Sales Only), PC A02/MF A01	DE87750779	MN -34D	12:10460
IPNO-GEPL-				
83-08	NTIS (US Sales Only), PC A03/MF A01	DE87750764	MN -28	12:9751

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IPNO-T-				
84-07	NTIS (US Sales Only), PC A11/MF A01	DE87750750	MN -37	12:9812
85-05	NTIS (US Sales Only), PC A04/MF A01	DE87750766	MN -34C	12:10309
85-07	NTIS (US Sales Only), PC A08/MF A01	DE87750711	MN -34C	12:10416
85-08	NTIS (US Sales Only), PC A12/MF A01	DE87750738	MN -4	12:9615
85-09	NTIS (US Sales Only), PC A07/MF A01	DE87750752	MN -34C	12:10342
IPNO-TH-				
85-23	NTIS (US Sales Only), PC A03/MF A01	DE87750783	MN -34D	12:10274
85-38	NTIS (US Sales Only), PC A03/MF A01	DE87750782	MN -34D	12:10239
85-46	NTIS (US Sales Only), PC A02/MF A01	DE87750777	MN -34D	12:10240
85-47	NTIS (US Sales Only), PC A02/MF A01	DE87750778	MN -34D	12:10183
85-49	NTIS (US Sales Only), PC A02/MF A01	DE87750757	MN -34C	12:10367
85-52	NTIS (US Sales Only), PC A02/MF A01	DE87750729	MN -34C	12:10368
85-54	NTIS (US Sales Only), PC A05/MF A01	DE87750773	MN -34D	12:10264
85-60	NTIS (US Sales Only), PC A05/MF A01	DE87750784	MN -34D	12:10241
86-05	NTIS (US Sales Only), PC A02/MF A01	DE87750731	MN -34C	12:10369
86-10	NTIS (US Sales Only), PC A02/MF A01	DE87750730	MN -34C	12:10370
86-25	NTIS (US Sales Only), PC A02/MF A01	DE87750780	MN -34D	12:10275
IPP-				
4/ 228	NTIS (US Sales Only), PC A03/MF A01	DE87750327	MN -20d	12:10561
6/ 263	NTIS (US Sales Only), PC A03/MF A01	DE87750328	MN -20f	12:10494
III/ 113	NTIS (US Sales Only), PC A02/MF A01	DE87750331	MN -20f	12:10495
IPPJ-				
725	NTIS (US Sales Only), PC A11/MF A01	DE87780044	MN -21	12:10563
727	NTIS (US Sales Only), PC A07/MF A01	DE87780043	MN -20f	12:10513
IS-T-				
1214	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE87003054	MN -37	12:9868
1226	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE87003051	MN -38	12:9685
1244	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE87003049	MN -25	12:9382
1245	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE87003045	MN -25	12:9461
1246	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE87003048	MN -25	12:9383
1249	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE87003052	MN -34D	12:10184
1250	NTIS, PC A09/MF A01 (GPO Dep.)	E 1.99: DE87003047	MN -25	12:9462
1275	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE87003050	MN -34A	12:10435
ISPO-				
196	*See* BNL-38584	E 1.99: DE87003224	MN -15	12:9011
ISS-R-				
84/ 4	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900294	MN -41	12:10057
ISS-T-				
84/ 1	NTIS (US Sales Only), PC A04/MF A01; 1	DE87900293	MN -41	12:10058
ITEF-				
69(1984)	NTIS (US Sales Only), PC A03/MF A01	DE87700201	MN -34D	12:10242
ITF-				
85-21-R	NTIS (US Sales Only), PC A02/MF A01	DE87700209	MN -34C	12:10371
ITP-				
84-179-E	NTIS (US Sales Only), PC A02/MF A01	DE87700206	MN -34C	12:10372
85-15-E	NTIS (US Sales Only), PC A02/MF A01	DE87700181	MN -34D	12:10276
85-29-E	NTIS (US Sales Only), PC A02/MF A01	DE87700178	MN -34D	12:10461
85-33-E	NTIS (US Sales Only), PC A02/MF A01	DE87700202	MN -34D	12:10243
85-48-E	NTIS (US Sales Only), PC A02/MF A01	DE87700198	MN -34B	12:10124
85-61-E	NTIS (US Sales Only), PC A02/MF A01	DE87700247	MN -34B	12:10125
JAERI-M-				
84-242	NTIS (US Sales Only), PC A06/MF A01	DE87700310	MN -32	12:9108
84-245	NTIS (US Sales Only), PC A08/MF A01	DE87700282	MN -78	12:9088
85-003	NTIS (US Sales Only), PC A02/MF A01	DE87700287	MN -80	12:9144
85-004	NTIS (US Sales Only), PC A04/MF A01	DE87700288	MN -37	12:9813
85-010	NTIS (US Sales Only), PC A04/MF A01	DE87700311	MN -32	12:10650
85-013	NTIS (US Sales Only), PC A03/MF A01	DE87700312	MN -32	12:9188
85-038	NTIS (US Sales Only), PC A07/MF A01	DE87700257	MN -4	12:9506
85-098	NTIS (US Sales Only), PC A02/MF A01	DE87700259	MN -4	12:9550
JINR-				
E-1-84-408	NTIS (US Sales Only), PC A02/MF A01	DE87700211	MN -34C	12:10338
E-1-85-524	NTIS (US Sales Only), PC A02/MF A01	DE87700481	MN -34C	12:10288
E-2-85-260	NTIS (US Sales Only), PC A02/MF A01	DE87700203	MN -34D	12:10244
R-1-85-495	NTIS (US Sales Only), PC A02/MF A01	DE87700254	MN -34C	12:10329
R-2-85-481	NTIS (US Sales Only), PC A02/MF A01	DE87700185	MN -34D	12:10373
R-4-85-151	NTIS (US Sales Only), PC A02/MF A01	DE87700210	MN -34C	12:10374
R-5-85-460	NTIS (US Sales Only), PC A02/MF A01	DE87700186	MN -34D	12:10375
JPL-PUB-				
85-43-VOL-2-PT-A	*See* N-86-33177			12:9488
86-19	*See* N-86-32910			12:9834
Juel-				
2048	NTIS (US Sales Only), PC A07/MF A01	DE87750310	MN -28	12:9752
2049	NTIS (US Sales Only), PC A04/MF A01	DE87750333	MN -98	12:9231
2053	NTIS (US Sales Only), PC A04/MF A01	DE87750309	MN -32	12:10651
2058	NTIS (US Sales Only), PC A04/MF A01	DE87750330	MN -20d	12:10564
Juel-Spez-				
316	NTIS (US Sales Only), PC A13/MF A01	DE87750303	MN -34C	12:10417
K/CSD/TM-				
60	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003585	MN -32	12:10624
65	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003591	MN -38	12:9668
K/HS-				
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003311	MN -15	12:9014

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K/OA-				
5826	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002803	MN -15	12:9015
6009	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002524	MN -15	12:9016
K/PS-				
798	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002525	MN -4	12:9616
817	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002316	MN -4	12:9393
923	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002802	MN -4	12:9552
K/TR-				
86/ 14	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002797	MN -47	12:8903
KEK-				
84-2	NTIS (US Sales Only), PC A03/MF A01	DE87700278	MN -28	12:9753
84-14	NTIS (US Sales Only), PC A17/MF A01	DE87780049	MN -34D	12:10171
84-20	NTIS (US Sales Only), PC A18/MF A01	DE87780048	MN -34C	12:10290
85-4	NTIS (US Sales Only), PC A09/MF A01	DE87780045	MN -34D	12:10464
85-5	NTIS (US Sales Only), PC A25/MF A01	DE87780046	MN -34D	12:10172
85-6	NTIS (US Sales Only), PC A17/MF A01	DE87780047	MN -34D	12:10173
85-7	NTIS (US Sales Only), PC A02/MF A01	DE87700279	MN -28	12:9761
KFK-				
4077	NTIS (US Sales Only), PC A02/MF A01	DE87750326	MN -15	12:9017
4090	NTIS (US Sales Only), PC A02/MF A01	DE87750311	MN -28	12:9721
4091	NTIS (US Sales Only), PC A04/MF A01	DE87750314	MN -38	12:9669
4095	NTIS (US Sales Only), PC A08/MF A01	DE87750313	MN -22	12:9617
4108	NTIS (US Sales Only), PC A03/MF A01	DE87750325	MN -11	12:9912
4110	NTIS (US Sales Only), PC A03/MF A01	DE87750317	MN -34D	12:10217
4122	NTIS (US Sales Only), PC A03/MF A01	DE87750315	MN -38	12:9670
KFK-PEF-				
6	NTIS (US Sales Only), PC A04/MF A01; 1	DE87750803	MN -38	12:9693
KFKI-				
1986-14/ K	NTIS (US Sales Only), PC A03/MF A01	DE87700289	MN -37	12:9828
1986-19/ A	NTIS (US Sales Only), PC A02/MF A01	DE87700251	MN -34C	12:10385
1986-24/ A	NTIS (US Sales Only), PC A02/MF A01	DE87700250	MN -34C	12:10386
1986-26/ E	NTIS (US Sales Only), PC A02/MF A01	DE87700244	MN -34D	12:10465
1986-75/ M	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900267	MN -32	12:10652
KFTI-				
84-4	NTIS (US Sales Only), PC A02/MF A01	DE87700182	MN -34D	12:10277
84-8	NTIS (US Sales Only), PC A03/MF A01	DE87700197	MN -20	12:10514
84-9	NTIS (US Sales Only), PC A02/MF A01	DE87700472	MN -37	12:9829
84-15	NTIS (US Sales Only), PC A02/MF A01	DE87700196	MN -20	12:10515
84-20	NTIS (US Sales Only), PC A02/MF A01	DE87700471	MN -37	12:9830
84-21	NTIS (US Sales Only), PC A02/MF A01	DE87700190	MN -20	12:10468
84-26	NTIS (US Sales Only), PC A02/MF A01	DE87700207	MN -34C	12:10387
KMSF-U-				
1754	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002822	MN -21	12:10565
KMU-HEP-				
85-06	NTIS (US Sales Only), PC A03/MF A01	DE87700183	MN -34D	12:10278
85-07	NTIS (US Sales Only), PC A02/MF A01	DE87700184	MN -34D	12:10279
KTA-GS-				
49	NTIS (US Sales Only), PC A04/MF A01	DE87750321	MN -80	12:9189
KURRI-TR-				
247	NTIS (US Sales Only), PC A04/MF A01	DE87780041	MN -20c	12:9481
249	NTIS (US Sales Only), PC A07/MF A01	DE87780042	MN -80	12:10421
250	NTIS (US Sales Only), PC A04/MF A01	DE87700313	MN -2	12:9245
263	NTIS (US Sales Only), PC A05/MF A01	DE87700246	MN -34A	12:9483
268	NTIS (US Sales Only), PC A04/MF A01	DE87780040	MN -80	12:9124
LA-				
161/ 86	*See* OEFZS-4366	DE87700470	MN -37	12:9869
163/ 86	*See* OEFZS-4369	DE87700216	MN -51	12:9948
10798-MS	*See* NUREG/CR-4720	TI87002948	MN -70B	12:8998
LA-UR-				
86-3398	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001955	MN -28	12:10218
86-3400	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001956	MN -32	12:10653
86-3533	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001952	MN -34D	12:10256
86-3596	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001972	MN -11	12:9887
86-3690	NTIS, PC A02/MF A01 - GPO	TI87001983	MN -78	12:9190
86-3691	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001984	MN -78	12:9191
86-3692	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001985	MN -78	12:9192
86-3693	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001986	MN -78	12:9193
86-3694	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001987	MN -78	12:9194
86-3695	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001988	MN -78	12:9195
86-3744	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002928	MN -48	12:10038
86-3749	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002926	MN -34D	12:10219
86-3760	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002925	MN -28	12:9722
86-3761	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002924	MN -28	12:9733
86-3771	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002921	MN -32	12:10654
86-3789	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002916	MN -34B	12:10388
86-3811	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002914	MN -25	12:9397
86-3813	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002913	MN -20f	12:10567
86-3819	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002912	MN -34	12:10436
86-3820	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002911	MN -34	12:10437
86-3844	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002909	MN -34	12:10168
86-3847	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002908	MN -34	12:10441
86-3855	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002906	MN -32	12:10655
86-3859	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002905	MN -34C	12:10303
86-3860	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002904	MN -34C	12:10313

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86-3875	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002903	MN -20d	12:10568
86-3887	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002902	MN -32	12:10656
86-3980	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002899	MN -34B	12:10389
86-3985	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002898	MN -28	12:9762
86-3997	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002896	MN -25	12:9398
86-3998	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002894	MN -34C	12:10390
86-4012	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002895	MN -34C	12:10391
86-4041	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002893	MN -25	12:9399
86-4047	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002892	MN -25	12:9441
86-4048	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002891	MN -45	12:9873
86-4052	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002890	MN -34	12:10162
86-4066	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002889	MN -25	12:9400
LAFI-				
073	NTIS (US Sales Only), PC A04/MF A01	DE87700482	MN -34C	12:10339
LAL-RT-				
86-02	NTIS (US Sales Only), PC A03/MF A01	DE87750746	MN -28	12:9734
LBL-				
19173	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003634	STD -34D	12:10174
19683	NTIS, PC A03/MF A01	DE87003618	ND -95d	12:9299
20659	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE87003632	STD -94c	12:9223
20660	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE87003631	STD -25	12:9224
20871	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001887	MN -4	12:9627
21230	NTIS, PC A02; 3	DE87002571	MN -28	12:9763
21292	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002547	MN -28	12:9735
21297	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002572	MN -28	12:9764
21772	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003640	STD -4	12:9553
21773	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003641	STD -4	12:9554
21790	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002566	MN -25	12:9401
21929	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003633	STD -38	12:9687
21931	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003635	STD -38	12:9832
21999	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003629	STD -34A	12:10163
22036	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001716	MN -4	12:9601
22105	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001890	MN -94cc	12:9602
22142	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE87001724	MN -4	12:9604
22196	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003625	STD -4	12:9555
22248	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002575	MN -34D	12:10291
22331	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002546	MN -25	12:9402
22349	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003642	STD -28	12:9723
22409	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE87003626	STD -95d	12:9300
22416	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003638	STD -48	12:10059
22421	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003643	STD -28	12:9724
22498	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003623	STD -28	12:10516
LPCC-T-				
85-01	NTIS (US Sales Only), PC A07/MF A01	DE87750745	MN -34C	12:10333
LRP-				
236/ 84	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900197	MN -20a	12:10569
237/ 84	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900198	MN -20a	12:10517
238/ 84	NTIS (US Sales Only), PC A05/MF A01; 1	DE87900199	MN -20a	12:10518
243/ 84	NTIS (US Sales Only), PC A02/MF A01	DE87900193	MN -20	12:10519
247/ 84	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900206	MN -20	12:10570
263/ 85	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900186	MN -20	12:10520
272/ 85	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900189	MN -20g	12:10521
276/ 85	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900188	MN -20	12:10522
277/ 85	NTIS (US Sales Only), PC A02/MF A01	DE87900187	MN -20	12:10571
287/ 86	NTIS (US Sales Only), PC A02/MF A01	DE87900204	MN -20	12:10523
LYCEN-				
8546	NTIS (US Sales Only), PC A02/MF A01	DE87750781	MN -34D	12:10257
8555	NTIS (US Sales Only), PC A02/MF A01	DE87750760	MN -34	12:10466
MAE-				
1731	*See* AD-A-172429/3/XAB			12:9625
MHD-III-				
86-066	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002854	MN -90g	12:9279
MI-				
87/ 86	*See* OEFZS-A-0886		ND -2	12:10689
MIT/LCS/TM-				
304	*See* AD-A-172224/8/XAB			12:10625
MLM-				
3398(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003026	MN -34	12:10438
3399(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003025	MN -25	12:9031
3406(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003020	MN -22	12:9556
3407(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003021	MN -70A	12:8967
3408(OP)	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003022	MN -15	12:9018
3409-OP	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003023	MN -15	12:9019
MLM-MU-				
86-71-0001	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002960	MN -38	12:9636
86-71-0004	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003619	MN -25	12:9403
MPI-PAE/Exp.El.-				
164	NTIS (US Sales Only), PC A03/MF A01	DE87750316	MN -37	12:9833
N-				
86-31649	NTIS HC A02/MF A01			12:9637
86-31652	NTIS HC A03/MF A01			12:9671
86-31665	NTIS HC A06/MF A01			12:9484
86-31826	NTIS HC A04/MF A01			12:9672
86-31858	NTIS HC A02/MF A01			12:9485

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86-31890	NTIS HC A03/MF A01			12:9638
86-31982	NTIS HC A03/MF A01			12:9220
86-32268	NTIS HC A03/MF A01			12:9486
86-32289	NTIS HC A02/MF A01			12:10148
86-32374	NTIS HC A02/MF A01			12:10128
86-32375	NTIS HC A03/MF A01			12:10129
86-32376	NTIS HC A03/MF A01			12:10130
86-32377	NTIS HC A03/MF A01			12:10131
86-32378	NTIS HC A02/MF A01			12:10132
86-32381	NTIS HC A02/MF A01			12:10133
86-32382	NTIS HC A04/MF A01			12:10134
86-32573	NTIS HC A02/MF A01			12:9487
86-32717	NTIS HC A02/MF A01			12:9646
86-32876	NTIS HC A02/MF A01			12:9046
86-32910	NTIS HC A04/MF A01			12:9834
86-33025	NTIS HC A02/MF A01			12:9628
86-33043	NTIS HC A08/MF A01			12:9673
86-33128	NTIS HC A04/MF A01			12:9557
86-33129	NTIS HC A03/MF A01			12:9835
86-33177	NTIS HC A25/MF A01			12:9488
86-33259	NTIS HC A02/MF A01			12:9025
86-33260	NTIS HC A03/MF A01			12:10135
NAGRA-NGB-				
85-03	NTIS (US Sales Only), PC A11/MF A01; 1	DE87900174	MN -70	12:8968
85-04	NTIS (US Sales Only), PC A15/MF A01; 1	DE87900175	MN -70	12:8969
85-05	NTIS (US Sales Only), PC A12/MF A01; 1	DE87900176	MN -70	12:8970
85-06	NTIS (US Sales Only), PC A09/MF A01; 1	DE87900173	MN -70	12:8971
85-07	NTIS (US Sales Only), PC A12/MF A01; 1	DE87900255	MN -70	12:8972
NAGRA-NTB-				
84-23	NTIS (US Sales Only), PC A04/MF A01; 1	DE87900265	MN -70	12:8973
84-29	NTIS (US Sales Only), PC A09/MF A01; 1	DE87900264	MN -70	12:10098
84-34	NTIS (US Sales Only), PC A08/MF A01; 1	DE87900262	MN -70	12:8974
84-35	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900277	MN -70	12:9404
84-37	NTIS (US Sales Only), PC A03/MF A01; 1	DE87900270	MN -70	12:10107
84-38	NTIS (US Sales Only), PC A06/MF A01	DE87900276	MN -70	12:8975
85-01	NTIS (US Sales Only), PC A09/MF A01; 1	DE87900261	MN -70	12:10090
85-04	NTIS (US Sales Only), PC A05/MF A01; 1	DE87900316	MN -70	12:10091
85-05	NTIS (US Sales Only), PC A07/MF A01; 1	DE87900244	MN -70	12:10113
85-06	NTIS (US Sales Only), PC A15/MF A01; 1	DE87900172	MN -70	12:10092
85-09	NTIS (US Sales Only), PC A08/MF A01; 1	DE87900253	MN -70	12:10093
85-14	NTIS (US Sales Only), PC A09/MF A01; 1	DE87900260	MN -70	12:10094
85-29	NTIS (US Sales Only), PC A05/MF A01; 1	DE87900254	MN -70	12:10095
85-30	NTIS (US Sales Only), PC A04/MF A01	DE87900263	MN -70	12:10108
85-51	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900257	MN -70	12:9442
85-52	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900259	MN -70	12:9489
NAS-				
1.15:86817	*See* N-86-32268			12:9486
1.15:87255	*See* N-86-31649			12:9637
1.15:87320	*See* N-86-31982			12:9220
1.15:87787	*See* N-86-33260			12:10135
1.15:88239	*See* N-86-31890			12:9638
1.15:88251	*See* N-86-32375			12:10129
1.15:88776	*See* N-86-33128			12:9557
1.15:88786	*See* N-86-31652			12:9671
1.15:88828	*See* N-86-32573			12:9487
1.15:89041	*See* N-86-32876			12:9046
1.26:176859	*See* N-86-32376			12:10130
1.26:176862	*See* N-86-32382			12:10134
1.26:176863	*See* N-86-32377			12:10131
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1.26:176870	*See* N-86-32374			12:10128
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1.26:177891	*See* N-86-32381			12:10133
1.26:178168	*See* N-86-33025			12:9628
1.26:178898	*See* N-86-32289			12:10148
1.26:179659	*See* N-86-31665			12:9484
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1.26:179746	*See* N-86-33177			12:9488
1.26:179751	*See* N-86-32910			12:9834
1.26:179768	*See* N-86-32717			12:9646
NASA-CR-				
174983	*See* DOE/NASA-0247-3	E 1.99: DE87002841	STD -60	12:9076
176859	*See* N-86-32376			12:10130
176862	*See* N-86-32382			12:10134
176863	*See* N-86-32377			12:10131
176864	*See* N-86-31858			12:9485
176870	*See* N-86-32374			12:10128
177062	*See* N-86-33129			12:9835
177065	*See* N-86-33043			12:9673
177891	*See* N-86-32381			12:10133
178168	*See* N-86-33025			12:9628

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178898	*See* N-86-32289			12:10148
179659	*See* N-86-31665			12:9484
179662	*See* N-86-31826			12:9672
179667	*See* N-86-32378			12:10132
179743	*See* N-86-33259			12:9025
179746	*See* N-86-33177			12:9488
179751	*See* N-86-32910			12:9834
179768	*See* N-86-32717			12:9646
NASA-TM-				
86817	*See* N-86-32268			12:9486
87255	*See* N-86-31649			12:9637
87320	*See* N-86-31982			12:9220
87787	*See* N-86-33260			12:10135
88239	*See* N-86-31890			12:9638
88251	*See* N-86-32375			12:10129
88776	*See* N-86-33128			12:9557
88786	*See* N-86-31652			12:9671
88828	*See* N-86-32573			12:9487
88891	*See* DOE/NASA/50112-67	E 1.99: DE87003288	STD -96	12:9340
89041	*See* N-86-32876			12:9046
NBSIR-				
86-3431	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99: DE87003057	MN -34A	12:10164
NIAE-Trans-				
532	British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ		ND -95d	12:9301
NIRS-RSD-				
66	NTIS (US Sales Only), PC A03/MF A01	DE87780032	MN -11	12:9945
68	NTIS (US Sales Only), PC A02/MF A01	DE87780033	MN -11	12:9947
NKA/LIT-				
85-4	NTIS (US Sales Only), PC A07/MF A01	DE87750414	MN -80	12:9135
NMRDI-				
2-73-4614	NTIS, PC A04/MF A01 - New Mexico Research and Devlopment Institute, Suite M, 457 Washington S.E., Albuquerque, NM 87108; 1	DE87003157	MN -95d	12:9302
NP-				
7750796	NTIS (US Sales Only), PC A04/MF A01; 1	DE87750796	MN -98	12:9261
7750798	NTIS (US Sales Only), PC A06/MF A01; 1	DE87750798	MN -11	12:9985
7750802	NTIS (US Sales Only), PC A06/MF A01	DE87750802	MN -11	12:9933
7750804	NTIS (US Sales Only), PC A03/MF A01	DE87750804	MN -92	12:8889
7750806	NTIS (US Sales Only), PC A03/MF A01	DE87750806	MN -13	12:9240
7750808	NTIS (US Sales Only), PC A02/MF A01	DE87750808	MN -98	12:9262
7750809	NTIS (US Sales Only), PC A02/MF A01; 1	DE87750809	MN -98	12:9263
7750810	NTIS (US Sales Only), MF A01; 2	DE87750810	MN -11	12:9888
7750812	NTIS (US Sales Only), PC A09/MF A01; 1	DE87750812	MN -97	12:9079
7770033	NTIS (US Sales Only), PC A09/MF A01; 1	DE87770033	MN -95d	12:9303
7770034	NTIS (US Sales Only), MF A01; 2	DE87770034	MN -97	12:9277
7770035	NTIS (US Sales Only), PC A05/MF A01	DE87770035	MN -93	12:9259
7770036	NTIS (US Sales Only), PC A09/MF A01; 1	DE87770036	MN -38	12:9639
7770037	NTIS (US Sales Only), PC A07/MF A01	DE87770037	MN -59A	12:9069
7770038	NTIS (US Sales Only), PC A09/MF A01; 1	DE87770038	MN -90a	12:8845
7770039	NTIS (US Sales Only), PC A05/MF A01; 1	DE87770039	MN -90d	12:8833
7770040	NTIS (US Sales Only), PC A07/MF A01; 1	DE87770040	MN -90c	12:8834
7770041	NTIS (US Sales Only), PC A07/MF A01; 1	DE87770041	MN -90a	12:8846
7770042	NTIS (US Sales Only), PC A08/MF A01; 1	DE87770042	MN -90a	12:8847
7770043	NTIS (US Sales Only), PC A06/MF A01; 1	DE87770043	MN -88	12:8855
7770044	NTIS (US Sales Only), PC A08/MF A01	DE87770044	MN -88	12:8856
7770045	NTIS (US Sales Only), PC A08/MF A01; 1	DE87770045	MN -11	12:9889
7900240	NTIS (US Sales Only), PC A06/MF A01; 1	DE87900240	MN -20	12:10572
7900249	Welch Foundation, 4605 Post Oak Place Drive, Suite 200, Houston, TX 77027	TI87900249	MN -4	12:9498
7900252	NTIS (US Sales Only), PC A12/MF A01; 1	DE87900252	MN -59B	12:9063
7900275	NTIS (US Sales Only), PC A02/MF A01; 1	DE87900275	MN -28	12:9765
NRL-MR-				
5892	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003663	MN -21	12:10573
NUB-				
2664	Department of Physics, Northeastern University, Boston, MA 02115	TI87900315	MN -34D	12:10280
NUCLEBRAS-CDTN-				
487	NTIS (US Sales Only), PC A02/MF A01	DE87700463	MN -78	12:9101
523	NTIS (US Sales Only), PC A03/MF A01	DE87700464	MN -78	12:9102
532	NTIS (US Sales Only), PC A02/MF A01	DE87700468	MN -80	12:9152
535	NTIS (US Sales Only), PC A02/MF A01	DE87700469	MN -80	12:9153
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1057-Suppl.3	NTIS, PC A03/MF A01 - GPO	TI87900170	MN -78	12:9196
1204	NTIS, PC A20/MF A01 - GPO	TI87900298	MN -78	12:9089
NUREG/CR-				
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3963	NTIS, PC A03/MF A01 - GPO	TI87900297	MN -78	12:9197
4306	NTIS, PC A12/MF A01 - GPO	TI87002282	MN -78	12:9198
4469-Vol.3	NTIS, PC A04/MF A01 - GPO	TI87002467	MN -78	12:9123
4512	NTIS, PC A09/MF A01 - GPO	TI87003237	MN -78	12:9199
4537	NTIS, PC A19/MF A01 - GPO	TI87003192	MN -78	12:9200
4563	NTIS, PC A07/MF A01 - GPO	TI87003019	MN -78	12:9201
4614	NTIS, PC AO3-MF A01 - GPO	TI87002716	MN -78	12:9132

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4630	NTIS, PC A05/MF A01 - GPO	TI87001876	MN -78	12:9202
4684-Vol.1	NTIS, PC A08/MF A01 - GPO	TI87003028	MN -78	12:9154
4684-Vol.2	NTIS PC E12/MF $7.30 - GPO	TI87003042	MN -78	12:9155
4697	NTIS, PC A03/MF A01 - GPO	TI87000197	MN -78	12:9203
4720	NTIS, PC A09/MF A01 - GPO	TI87002948	MN -70B	12:8998
4764	NTIS, PC A12/MF A01 - GPO	TI87002285	MN -78	12:9090
NVO-				
277	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003610	MN -11	12:9878
NYSERDA-				
86-8	NYSERDA, Rockefeller Plaza, Albany, NY 12223; 1	TI87900299	MN -95d	12:9304
OEFZS-				
4366	NTIS (US Sales Only), PC A02/MF A01	DE87700470	MN -37	12:9869
4369	NTIS (US Sales Only), PC A03/MF A01	DE87700216	MN -51	12:9948
OEFZS-A-				
0886	Austrian Research Centre, A-2444 Seibersdorf, Austria		ND -2	12:10689
ORNL-				
4169/ V2/ S2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002978	STD -80	12:9204
5913	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE87002986	STD -11	12:9919
6146	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE87002969	MN -41	12:9949
6324	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002970	STD -80	12:9156
ORNL/M-				
174	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003309	MN -41	12:9997
258	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87002879	MN -61C	12:9047
ORNL/PPA-				
86/ 2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE87002991	MN -2	12:9246
ORNL/Sub-				
84-17600/ 1	*See* NUREG/CR-4306	TI87002282	MN -78	12:9198
86-86004/ 7	*See* NUREG/CR-4764	TI87002285	MN -78	12:9090
ORNL/TM-				
9817	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87002955	STD -11	12:9904
10045	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE87001633	MN -78	12:9205
10052	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE87002981	MN -98F	12:9276
10135	*See* NUREG/CR-4697	TI87000197	MN -78	12:9203
10150	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002984	STD -20g	12:10524
10190	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87002973	STD -4	12:9507
10275	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002976	MN -80	12:9157
ORNL/tr-				
86/ 31	NTIS, PC A18/MF A01; 1 (GPO Dep.)	E 1.99: DE87003176	MN -70	12:8990
86/ 55	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002424	MN -11	12:9953
86/ 57	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002423	MN -4	12:9599
86/ 59	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE87003175	MN -86	12:8907
ORO-				
3948-18	*See* DOE/ER/03948-18	E 1.99: DE87003326	MN -34C	12:10307
PATENTS-US-	(US: Commissioner of Patents, Washington, D.C. 20231, USA, $1.00 per copy. Government Patent Applications available from NTIS)			
4,622,355				12:9495
4,622,754				12:9310
4,622,757				12:9309
4,622,812				12:9287
4,622,819				12:9697
4,622,829				12:9308
4,622,844				12:9345
4,622,865				12:9343
4,622,867				12:9342
4,622,921				12:9696
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4,622,924				12:9333
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4,622,944				12:9323
4,622,946				12:9695
4,622,947				12:9694
4,622,951				12:9064
4,623,022				12:8872
4,623,360				12:9334
4,623,361				12:9336
4,623,362				12:9335
4,623,363				12:9337
4,623,365				12:9699
4,623,371				12:8894
4,623,388				12:9494
4,623,443				12:9584
4,623,444				12:8900
4,623,445				12:9583
4,623,446				12:9582

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4,623,447				12:8886
4,623,473				12:8887
4,623,508				12:9092
4,623,510				12:8988
4,623,511				12:9133
4,623,523				12:9907
4,623,532				12:9039
4,623,597				12:9227
4,623,599				12:9226
4,623,600				12:9225
4,623,601				12:9053
4,623,632				12:9581
4,623,634				12:9038
PB-				
87-100590/ XAB	NTIS, PC A02/MF A01			12:10080
PCCF-T-				
85-05	NTIS (US Sales Only), PC A08/MF A01	DE87750747	MN -37	12:9836
85-06	NTIS (US Sales Only), PC A06/MF A01	DE87750744	MN -37	12:9837
85-07	NTIS (US Sales Only), PC A08/MF A01	DE87750748	MN -37	12:9838
PER-				
98	NTIS (US Sales Only), PC A03/MF A01	DE87700273	MN -41	12:9920
PFC/CP-				
86-12	*See* DOE/ET/51013-195	E 1.99: DE87002770	MN -20	12:10551
86-13	*See* DOE/ET/51013-196	E 1.99: DE87002771	MN -20b	12:10552
PNCT-N-				
433-84-01	NTIS (US Sales Only), PC A12/MF A01	DE87700266	MN -51	12:8902
PNL-				
4241-Vol.6	*See* NUREG/CR-2675-Vol.6	TI87003043	MN -70B	12:8997
5322-Exec.Summ.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003291	MN -95	12:9316
5621	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE87003697	MN -98	12:9305
5711-Vol.3	*See* NUREG/CR-4469-Vol.3	TI87002467	MN -78	12:9123
5766	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003700	MN -70	12:9405
5863	*See* NUREG/CR-4614	TI87002716	MN -78	12:9132
5917	*See* EPRI-NP-4887	E 1.99: DE87003329	STD -85	12:8910
5943	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003597	MN -61D	12:9048
5944	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003599	MN -85	12:8920
5955	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE87003593	MN -95	12:9084
6064	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE87003588	MN -95d	12:9306
PNL-SA-				
13389	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001802	MN -48	12:9008
13506	NTIS, PC A02; 3	DE87002714	MN -98	12:9232
13609	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86012331	MN -41	12:10060
13685	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002710	MN -41	12:10061
13686	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002715	MN -41	12:10430
13738	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003172	MN -10	12:8976
13832	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003095	MN -11	12:10099
13885	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002712	MN -4	12:9508
13894	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003170	MN -11	12:9890
13954	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003406	MN -70	12:8977
14018	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003171	MN -95	12:9322
14056	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003093	MN -85	12:8978
14065	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003099	MN -70	12:8979
14069	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002872	MN -25	12:9406
14094	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003173	MN -41	12:10009
14125	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003308	MN -41	12:10062
14218	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002871	MN -25	12:9407
14223	NTIS, PC A02; 3	DE87002713	MN -32	12:10657
14291	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003094	MN -70B	12:8980
14331	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003300	MN -41	12:9905
14342	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003304	MN -70	12:8981
14371	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002473	MN -15	12:9020
14402	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003097	MN -15	12:9021
14411	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003301	MN -41	12:9839
14463	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003302	MN -70	12:8982
PPA-BEN-				
3	NTIS (US Sales Only), PC A09/MF A01	DE87780031	MN -4	12:9516
PPI-FID-				
300086	*See* DOE/NASA-0247-3	E 1.99: DE87002841	STD -60	12:9076
PPPL-				
2365	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003073	STD -20	12:10574
2372	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003068	STD -20g	12:10525
2376	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003069	STD -20g	12:10526
2378	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003067	STD -20c	12:10575
2379	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003070	STD -20f	12:10527
2383	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003079	STD -20	12:10576
2385	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003075	STD -20f	12:10528
2386	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003065	STD -20c	12:10577
2388	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003076	STD -20g	12:10529
2390	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003074	STD -20	12:10578
2393	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003071	STD -20a	12:10530
2397	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003072	STD -20a	12:10579
PRG-R-				
128	*See* DOE/DP/40207-1	E 1.99: DE87003120	MN -20a	12:10550

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PSR-				
676	*See* AD-A-172540/7/XAB			12:9877
PUC-TN-				
27/ 84	NTIS (US Sales Only), PC A02/MF A01	DE87700474	MN -37	12:9870
28/ 84	NTIS (US Sales Only), PC A02/MF A01	DE87700475	MN -37	12:9871
REG/G-				
344-Rev.2	Nuclear Regulatory Commission, Washington, DC 20555	TI87900157	MN -85	12:8921
REPT-				
49	*See* N-86-31665			12:9484
86B0418	*See* N-86-33260			12:10135
RERF-TR-				
9-85	NTIS (US Sales Only), PC A03/MF A01	DE87700269	MN -48	12:10063
15-84	NTIS (US Sales Only), PC A04/MF A01	DE87700268	MN -48	12:10064
RHO-BW-SA-				
462P	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003150	MN -70	12:8983
RHO-HS-SR-				
85-1P	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE87002947	MN -70	12:8984
RHO-RE-SR-				
86-24P	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE87002753	MN -70	12:8999
RIG-				
19	NTIS (US Sales Only), PC A07/MF A01	DE87700465	MN -77	12:9206
RRK-				
85-23	NTIS (US Sales Only), PC A02/MF A01	DE87700248	MN -34D	12:10258
85-24	NTIS (US Sales Only), PC A02/MF A01	DE87700245	MN -34D	12:10392
85-26	NTIS (US Sales Only), PC A03/MF A01	DE87700249	MN -34D	12:10259
SAIC-				
85/ 8000	*See* DOE/NV/10270-3	E 1.99: DE87002864	MN -70	12:10004
85/ 8001	*See* DOE/NV/10270-4	E 1.99: DE87002866	MN -70	12:10005
86/ 1904-PRI-105	NTIS, PC A02/MF A01; 1	DE87002681	STD -20g	12:10531
86/ 1928-PRI-106	NTIS, PC A03/MF A01; 1	DE87002636	STD -20g	12:10532
SAND-				
85-7114	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003587	MN -70	12:8985
85-7258	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003089	MN -4	12:9517
86-0153	*See* NUREG/CR-4512	TI87003237	MN -78	12:9199
86-0178C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86014141	MN -11	12:10109
86-0451	*See* NUREG/CR-4537	TI87003192	MN -78	12:9200
86-0531C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003038	MN -25	12:9490
86-0576	*See* NUREG/CR-4563	TI87003019	MN -78	12:9201
86-1136	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87003282	MN -32	12:9629
86-1307C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003030	MN -38	12:9647
86-1341C	NTIS, PC A02; 3	DE87002700	MN -38	12:9630
86-1359C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003031	MN -25	12:9408
86-1395C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003033	MN -25	12:9491
86-1402C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003034	MN -25	12:9492
86-1418C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003154	MN -25	12:9350
86-1582C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E1.99: DE87002486	MN -28	12:9766
86-1762	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87002729	STD -91	12:8899
86-1820	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003279	MN -2	12:9640
86-1834C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87000982	MN -79p	12:9207
86-1902	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87003594	MN -32	12:10658
86-1950C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001740	MN -78	12:9208
86-1966C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002492	MN -4	12:9558
86-1989C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002702	MN -78	12:9209
86-2110	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87003589	MN -13	12:10110
86-2192C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002484	MN -70	12:8986
86-2220C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87001732	MN -78	12:9210
86-2396C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87000981	MN -63	12:9049
86-2398	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE87003283	MN -32	12:10659
86-2426C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002477	MN -4	12:9559
86-2464C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001736	MN -78	12:9211
86-2520C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87001729	MN -78	12:9212
86-2521C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002054	MN -78	12:9213
86-2547C	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87002056	MN -78	12:9214
86-2562C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87002485	MN -78	12:9215
86-8018	NTIS PC E10/MF A01; 1 (GPO Dep.)	E 1.99: DE87003598	MN -62a	12:9056
86-8230	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003596	MN -13	12:9874
86-8243	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003590	MN -25	12:10580
86-8249	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003592	MN -62a	12:9057
SAPR-				
6	*See* N-86-33259			12:9025
7	*See* N-86-33259			12:9025
SAR-				
25	*See* N-86-32378			12:10132
SASR-				
7	*See* N-86-32374			12:10128
SCPRI-RM-				
1-1986	NTIS (US Sales Only), PC A03/MF A01	DE87750743	MN -11	12:9921
2-1986	NTIS (US Sales Only), PC A03/MF A01	DE87750770	MN -11	12:9922
3-1986	NTIS (US Sales Only), PC A03/MF A01	DE87750771	MN -11	12:9923
SERI/SP-				
273-2302	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85012136	MN -61A	12:9050
273-2966	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86010701	STD -59B	12:9307

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SERI/STR-					
211-3034	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001110	STD -63	12:9051
211-3051	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001112	STD -63	12:9052
SERI/TP-					
231-3023	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001121	MN -61E	12:9037
SERI/TR-					
252-2663	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001113	MN -62	12:9058
SFB-					
210/ E-18	NTIS (US Sales Only), PC A06/MF A01; 1		DE87750813	MN -12	12:9925
SLAC-					
305	NTIS, PC A03; 3		DE87003584	STD -32	12:10660
SLAC-CN-					
339	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87003223	MN -28	12:9736
SLAC-PUB-					
4018	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003270	MN -34D	12:10260
4042-Rev.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003274	MN -28	12:9725
4055	NTIS, PC A02; 3		DE87003273	MN -34D	12:10220
4064	NTIS, PC A02; 3		DE87003276	MN -28	12:9841
4070	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003272	MN -34D	12:10281
4073	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002995	MN -28	12:9737
4095	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003271	MN -28	12:9842
4102	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003278	MN -28	12:10221
4105	NTIS, PC A02; 3		DE87003277	MN -28	12:9843
4107	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003261	MN -28	12:9844
4108	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003260	MN -37	12:9845
4111	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003262	MN -28	12:9767
4116	NTIS, PC A02; 3		DE87003263	MN -28	12:9846
4130	NTIS, PC A02; 3		DE87003259	MN -37	12:9847
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